Distribution and important biological features of coastal fish resources in Southeast Asia

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PREPARATION OF THIS PAPER

This document has been prepared as part of FAO's Regular Programme activities, and aims to review all the available information on the biological features of the major marine resources in the region where intensive fishing has been carried out and where the establishment of a firm basis for rational management is therefore required. It also focuses on the preparation of geographic maps of important features of the major resources and fisheries to provide visual material for both resource assessment and management purposes.

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Gratitude should also be extended to the participants of the FAO/SEAFDEC Workshop on Shared Stocks in Southeast Asia, held in Bangkok on 18-22 February 1985 (FAO/SEAFDEC, 1985), who assisted in compiling and revising the contents of this study at the earlier stage of the study.

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1. INTRODUCTION

The waters in Southeast Asia constitute one of the most productive areas for commercial fisheries in the world oceans. The total annual catch from the region has increased steadily throughout the years and has reached about 6 million tons recently, which accounts for about 10 percent of the world total marine production.

Although all nations in the region have traditionally harvested marine resources in their coastal waters, the history and the current status of the fisheries vary greatly from country to country. For instance, trawl fishing was first initiated in Thailand in the early 1960s, followed by Malaysia and Indonesia, while in the Philippines fishing for pelagic fish developed faster. In Kampuchea and Viet Nam, on the other hand, marine fishing has not developed well in recent years, due mostly to political disturbances. In Burma and Brunei, marine fishing has not been particularly intensive until recently. The same is true for East Malaysia, with the exception of shrimp fishing in Sabah. The historical development process and the current status of the fisheries in the region are reviewed in detail in another FAO publication (Shindo, in preparation).

Because of the development of these fisheries, many resources of the coastal waters of the region have become heavily exploited. Some stocks, especially demersal fish resources in nearshore waters, are believed to be over-exploited, and many coastal pelagic fish resources in shallower waters nearly fully exploitated in recent years. Under these circumstances, many countries have established several regulatory measures aiming at both the conservation of their resources and at the resolution or alleviation of the conflicts between fisheries and fishermen. On the other hand, it is believed that several other stocks in the region may not be fully exploited, and increased catches can therefore be expected from those stocks, especially in offshore areas.

In connection with the extension of national jurisdiction to 200 miles, the proper assessment and rational utilization of shared stocks, have recently become significantly important for both research and management purposes in the region. There is no doubt that international cooperation is critically important in the future to ensure better assessment and management of these resources.

Despite the serious state of many coastal resources in the region as mentioned above, explicit assessment has scarcely been made due mostly to the paucity of the biological information on the resources and the lack of adequate catch and effort data. Thus, it is considered to be the right time to review the biological information available so as to identify the gaps between present knowledge and the requirements for the future.

This paper presents a compilation of all available information on the coastal fish resources in the region, covering both important biological features and fisheries. The definition of the sea area employed in this study is given in Figure 1, and the bathymetric conditions of the area in Figure 2. The biological data are presented in both tabulated forms (Tables 1-6) and maps illustrating the geographic distribution of the resources and the migratory/displacement patterns of major species (Figures 3-21). Oceanic resources, such as skipjack and larger tunas, are excluded from this study, although the fishery has been quite intensive in the eastern part of the region in recent years. They are widely distributed in the Pacific Ocean beyond the border of this particular region, and are highly migratory in nature. The biological studies on these fish have been carried out by several tuna-fishing countries and international organizations, and the review of these studies is therefore beyond the scope of this particular study.

It is expected that the research institutes in the countries concerned will identify, from the information provided in this paper, the priority areas for their future research. It is also hoped that the paper will be useful for fisheries administrators in planning the proper management and development of the fisheries in their countries.

2. SOURCES

Data and information have been collected from both published reports and unpublished documents in various institutions and organizations in the region. Some have also been collected orally through interviews during the visit of the authors to national institutes in Hong Kong, Indonesia, Malaysia, the Philippines and Thailand. Visits were also made to several international organizations such as the Southeast Asian Fisheries Development Center (SEAFDEC) in Bangkok, the International Center for Living Aquatic Resources Managment (ICLARM), and FAO/UNDP South China Sea Fisheries Development and Coordinating Programme (SCSP), both in Manila.

It should be noted here that substantial additions and revisions of the information collected by the authors were made by the participants of the FAO/SEAFDEC Workshop on Shared Stocks in Southeast Asia held in Bangkok during 18-22 February 1985 (FAO/SEAFDEC, 1985), where the interim draft paper of this study was submitted for discussion.

The list of all the publications and documents referred to in this review is given in the References at the end of this paper. The specific literature to refer to in each of the species group or species is given in each of the following sections, sub-sections and tables in the paper. However, a few papers that have been used on a global basis throughout the study are given here. These are Morgan and Valencia (1983) and Wyrtki (1961) for resources/fisheries/environment in Southeast Asia, Marr (1976) and Tiews (1976) for resources/management in Southeast Asia, Shindo and Chullasorn (1980) for resources/fisheries in Southeast Asia, SEAFDEC (1984) for fishery statistics in Southeast Asia, FAO/SEAFDEC (1985) for shared stocks in Southeast Asia, Beales *et al*. (1982) for resources/fisheries in Brunei, Blanc (1960) and FAO (1980) for resources/fisheries in Kampuchea, Burma (1982) and Khin (1948) for resources/fisheries in Burma.

3. AREA EMPLOYED AND ENVIRONMENTAL CONDITIONS (Figures 1 and 2)

The marine waters covered here fall entirely in the tropical zone of Southeast Asia. They are composed of several major seas and straits (Figure 1), namely the Andaman Sea in the west, the Strait of Malacca, the South China Sea, the Java Sea, the Arafura Sea, the other Indonesian waters including the Makassar Strait, the Molucca, Flores, Savu, Timor and Banda Seas, the Indian Ocean along the Indonesian archipelago in the south, the Celebes Sea, the Sulu Sea, the other Philippino waters such as the Sibuyan, Visayan and Mindanao Seas, the Pacific Ocean along the Philippines to Indonesia coasts in the east and the Formosa Strait in the north, which connects the region to the East China Sea further north.

Twelve countries bordering on the region are all traditionally fishing nations though the magnitude of fishing effort varies from one to the other (Figure 1). They are Brunei, Burma, China including both the mainland and Taiwan Province, Hong Kong, Indonesia, Kampuchea, Macau, Malaysia, Philippines, Singapore, Thailand and Viet Nam.

Bathymetric conditions divide the region roughly into two parts, namely shallow and flat areas in the west where wide continental shelves have been well developed and deep sea areas in the east with narrow continental shelves and steep slopes (Figure 2). The former include the Strait of Malacca, the southern part of the South China Sea including the Gulf of Thailand, the Gulf of Tong King, the northwestern part of the South China Sea, the Java and Arafura Seas, while the rest of the region are covered by the latter. These characteristics principally determine the occurrence of exploitable resources. For instance, there are abundant demersal fish and shrimp/prawn resources in the former areas and oceanic fish resources such as skipjack and larger tunas in the latter.

The climatic and oceanographic conditions of the region are generally governed by the tropical monsoon regime (Wyrtki, 1961; Marr, 1976). The waters are also strongly influenced by the inflow from the neighbouring seas and oceans in accordance with the change in monsoons. For instance, during the northeast monsoon the water from the Pacific Ocean and the East China Sea move into the area through the northern part of the South China Sea, while during the southwest monsoon from both the Pacific and Indian Oceans through the southern part of the region, although the magnitude is smaller than the former.

The surface sea current in the region changes its direction completely in accordance with the two monsoon seasons, with the exception of the Malacca Strait where waters flow always in a northerly direction, although the intensity varies according to the season. However, seasonal changes in water temperature are very slight. The temperature usually ranges between 24° and 29°C throughout the year, with the exception of the northern part of the South China Sea where it decreases to below 24°C in winter due mostly to the inflow of cold waters from the East China Sea.

These are the distinctions in the environmental characteristics of the region that determine the species and ecological features of the resources. The region-specific features of the resources, which have been derived from the above-mentioned environment in the region, are the multispecies nature of fish community; the fast growing and early maturing of the individual fish with relatively short life span; and the multiple or almost all year-round prolonged spawning.

The region is also characterized by the abundant distribution of coral reefs, especially in the western-most and eastern parts, while mangroves are numerous where there is substantial discharge of fresh water. These environments also play an important role in enhancing the productivity of the coastal waters, providing favourable conditions for spawning and nursing of many fish and shrimp resources.

4. OCCURRENCE OF MAJOR SPECIES GROUPS AND SPECIES (Table 1)

The list of the major species groups and species reported to have been found in each of the national jurisdictional waters is given in Table 1. For pelagic fish, 46 groups have been identified and 29 species of commercial value have been confirmed to be commonly distributed; for demersal fish, 39 groups and 36 species; for shrimps, 8 groups and 13 species; and for squids/cuttlefish, 8 groups and 6 species. The information in the table was collected from the many references mentioned in the other sections and tables in this paper.

It should be noted, however, that the checklist shown in Table 1 is still incomplete for many species in some local waters as there has been insufficient research and study on the identification of fish species. Therefore, the blank columns in Table 1 do not mean the lack of species in that specific water but should be read as it being uncertain whether the species really occurs or not. The situation is particularly weak for squids and cuttlefish, which may be the result of the little research made so far due to the unpopularity of these resources in many countries, with the exception of Hong Kong and Thailand.

Despite the incompleteness of the above checklist, the table as a whole gives a clear picture of the multispecies nature of the major resources in the region with a number of species groups and species in each of the fish type categories.

5. IMPORTANT BIOLOGICAL FEATURES AND PARAMETERS OF MAJOR SPECIES (Tables 2 to 6)

The data and information on the important biological features of the major species are given in the subsequent tables, together with the substantive studies to be referred to for each species. They comprise 24 species of coastal small pelagic fish (Table 2), a king mackerel and three species of coastal tunas (Table 3), 42 species of demersal fish (Table 4), 18 species of shrimps (Table 5), and 11 species of cephalopods (Table 6). Some parameters vary according to the localities where sample specimens were taken, which may derive partly from the difference in ecological features caused by the various environmental conditions (e.g., spawning and growth) and partly from the magnitude of fishing intensity (e.g., mortality). For this reason, the results of the studies are given in these tables by country, locality and occasionally even by the scientist involved.

The data appear to be plentiful when taking a glance of the tables. However, it should be noted that their quantity and quality vary greatly according to the area surveyed. Such an imbalance in knowledge in the region is commonly observed in many species but is particularly serious for some specific species groups, e.g., coastal tunas and cephalopods.

Both the pelagic and demersal fish resources in Southeast Asia have become very important for commercial fisheries in many countries during the past two decades. The fisheries research institutes in those countries initiated intensive studies on their resources and have carried out quite a lot during the past twenty years. These activities have covered a number of important resources including two species of mackerels, three of round scads, four of anchovies, three of sardines, one of king mackerels, two of pony fish, two of threadfin breams, one of bigeye snappers and two of lizard fish. Apart from these species groups, information on the biology and ecology of shrimps and cephalopods is still limited. More intensified research and study are awaited in the immediate future for these resources.

6. GEOGRAPHIC DISTRIBUTION OF HABITAT, SPAWNING AND FISHING GROUNDS OF MAJOR SPECIES GROUPS (Figures 3 to 21)

The information on the distribution of resources, fishing grounds, concentration of abundance, spawning grounds and estimated migration pattern are shown in Figures 3-21 for the selected species groups of commercial value.

Several criteria were employed in selecting the species group to be illustrated in these figures, based mostly on the fact that they are important species for commercial fisheries, i.e., the larger quantity of the catch taken from the sea, the higher market price and the higher utility for foreign trade. The others included in the mapping are not being intensively or widely exploited at present; however, they are believed to have a large potential harvest for future exploitation.

The following sub-sections give annotations and interpretations for each of the figures provided in this study.

6.1 Coastal Pelagic Fish

The exploitation of coastal pelagic fish resources started a long time ago in Southeast Asia, before that of demersal fish resources. However, the number of species harvested has been considerably smaller than that of demersal fish. The most important species of commercial value are commonly found throughout the region, and include such genera as Rastrelliger, Decapterus, Sardinella, Stolephorus, Scomberomorus, several genera of carangids other than Decapterus and coastal tunas mainly composed of Euthynnus, Auxis and Thunnus tonggol. Mapping of the geographic distribution has been made for the seven major species groups: mackerels (Figure 3), round scads (Figure 4), sardines (Figure 5), anchovies (Figure 6), carangids (Figure 7), king mackerels (Figure 8) and coastal tunas (Figure 9).

The literature referred to in each of these species groups is given in each of the sub-sections. However, the following literatures have been used on a broader basis covering multiple species groups.

(1) Resources assessment:

SCSP (1978a) for South China Sea and SEAFDEC (1982) for Southeast Asia with emphasis on shared stocks.

(2) Resources and fisheries:

Menasveta, Shindo and Chullasorn (1973) for South China Sea, Boonragsa (1984) for the Andaman Sea, SCSP (1976, 1976a) for the Malacca Strait, Department of Fisheries, Thailand (1984), Menasveta (1980) and Supongpan et al. (1982) for the Gulf of Thailand, Fisheries Research Institute, Malaysia (1984) for Malaysia, Departemen Pertanian, Indonesia (1983) for Indonesia, SCSP (1979) for the Java Sea, Sujastani (1983) for Sumatra, Uktolseja et al. (1979) for Sulawesi, SCSP (1976b) for the Visayan and Sibuyan Seas, SCSP (1977) for the Sulu Sea, the Bohol Sea and the Moro Gulf, SCSP (1978b) for the Pacific coast of the Philippines, SCSP (1979a) for the north and west coasts of Luzon, and Chung and Chiu (1980) for Hong Kong.

(3) Resources research:

Aglen et al. (1981) for Malaysia and FAO (1975) for Viet Nam.

(4) Resources and biology (general):

Dwiponggo and Pauly (in press) for Indonesia and Ingles and Pauly (1984) for the Philippines.

(5) Larval survey:

Vattanachai (1974) for South China Sea, Chayakul et al. (1983) for the Gulf of Thailand and Ordonez et al. (1973) for the Philippines.

6.1.1 Mackerels (Figure 3)

There are three species of mackerels commonly found in the region (Table 1): Indo-Pacific mackerel or short mackerel (Rastrelliger brachysoma), Indian mackerel (R. kanagurta) and island mackerel (R. faughni). The first species is abundant in the coastal waters, while the second and the third are distributed more in offshore waters throughout the region. They are caught mainly by purse seine and gillnet, and occasionally by trawl. The fishing ground extends widely over the coastal waters in the region (Figure 3). It is noted that these three species are generally combined in fishery statistics in many countries as fishermen usually do not separate their catches for marketing.

Extensive studies on the biology and ecology of mackerels have been carried out for R. brachysoma and R. kanagurta in many waters, including the Gulf of Thailand, the Mergui Archipelago, the Andaman Sea, the Malaysian waters, the Java Sea and the Philippine waters. The biological features and parameters of mackerels are shown in Table 2, and their seasonal migratory patterns estimated from tagging experiments are given in Figure 21. The result of tagging also indicated that there may be a fairly long-range movement of R. brachysoma from the southern part of the west coast of Thailand to the west coast of the Malaysian Peninsula. This supports the hypothesis that the mackerel along the Andaman Sea coast is composed of a single stock being shared by the two or more countries bordering the sea.

In addition to the references already specified in Sections 2 and 6.1, the following literature refers specifically to mackerels in the region: Collette et al. (1983) for the entire region, SCSP (1978) for the South China Sea, Boonragsa et al., (1984), Bussarawitch (1984, 1984a, 1984b), and Druzhinin (1968) for the Andaman Sea, Chong and Chua (1974), FAO/UNDP Bay of Bengal Project (1985) and Pathansali (1961, 1967) for the Malacca Strait, Boonprakob (1965, 1967, 1972), Chullasorn (1979), Dhebtaranon and Chotiyaputta (1974), Somjaiwong et al. (1970), Suchondhamarn et al. (1970), Suvapepun and Suwanrumpha (1970), Tabtimtai (1968), Tantiswetratana (1979) and

Vanichkul and Hongskul (1965) for the Gulf of Thailand, Chee (1980) for Malaysia, Gafa (1982) for the Makassar Strait, Sujastani (1974) for the Java Sea and Tan (1970) for the Manila Bay.

6.1.2 Round scads[1/] (Figure 4)

Round scads in the region are represented by eight species of the genus *Decapterus* (Table 1). Among them, shortfin scad (*D. macrosoma*) and white tip scad (*D. maruadsi*) are the most common in many waters in the region. In Burmese waters Indian scad (*D. russelli*) is considered the most abundant species. However, there has been much confusion between *D. russelli* and *D. maruadsi* in many of the countries. It is impossible to examine the biological features for these two species further in detail unless the problem of species identification is sorted throughout the entire region. Under these circumstances, the catch statistics for round scads have generally been compiled on a species-combined basis. Similarly, for the other five minor species, the establishment of species identification and the confirmation of their distribution in this particular region are urgently awaited from a biological point of view. They include stout redtail scad (*D. kurroides*), mackerel scad (*D. macarellus*), amberstripe scad (*D. muroadsi*), temperate scad (*D. scombrinus*) and slender redtail scad (*D. tabl*).

Round scads are widely distributed in the region as is shown in Figure 4. They are caught by various types of purse seines, bagnets and gillnets in the offshore waters. There is a possibility of expanding the fishing on round scads to many parts of the region where it has not been intense and where the resources are believed to be abundant.

Biological information on round scads is geographically limited, i.e., the Palawan waters, the Gulf of Thailand and the Java Sea (Table 2). A recent workshop on shared stocks organized jointly by FAO and SEAFDEC recommended, in the light of the importance of these resources, that further research and study on this species group be carried out in the immediate future to meet assessment and management purposes.

The following publications refer specifically to round scads in the region: SCSP (1978) for the South China Sea, Wongchitsue (1984) for the Andaman Sea, FAO/UNDP Bay of Bengal Project (1985) for the Malacca Strait, Chantarasri (1980), Cheunpan (1981), Chullasorn and Yusukswad (1977) and Piyathirathitivorakul (1983a) for the Gulf of Thailand, Atmadja (1982) for the Arafura Sea, Sadhotomo (1983) for the Java Sea, Magnusson (1970), Ronquillo (1974) and Tiews, Ronquillo and Caces-Borja (1970) for the Philippines. See Sections 2 and 6.1 for global and broader references.

6.1.3 Sardines[2/] (Figure 5)

Although sardines in the region are composed of various genera of clupeoids, the fishery has depended mostly on the two genera, *Sardinella* and *Amblygaster*. There are 11 species reported from the region for these genera, but the major ones are confined to about five (Table 1).

Among these, fringescale sardinella (*S. fimbriata*), goldstripe sardinella (*S. gibbosa*) and spotted sardinella (*A. sirm* = *S. sirm*)[3/] are commonly found in almost all the countries in the region. It is interesting to see that the Indian oil sardine (*S. longiceps*) predominates in the sardine catch in the Bali Strait. In general, sardines are widely distributed in the coastal waters of the entire region (Figure 5). The major fishing gear employed are purse seines, gillnets and bagnets.

Biological studies on sardines have been carried out only for selected waters in the region, namely the waters around the Palawan, the Manila Bay, the Java Sea, the Bali and Malacca Straits and the Gulf of Thailand (Table 2).

The following literature refers specifically to sardines in the region: Whitehead (1985) for the entire region, Chullasorn (1979a) for the Gulf of Thailand, Dwiponggo (1974), Dwiponggo and Uktolseya (1974), Ritterbush (1975) and Sujastani and Nurhakim (1982) for the Bari Strait and Ronquillo (1960) for the Philippines. See Sections 2 and 6.1 for global and broader references.

1/ The English names employed in this sub-section are those used in FAO species catalogue. Carangids of the world, by W. Smith-Vaniz (in preparation)

2/ The English and scientific names employed in this sub-section refer to those defined in the FAO species catalogue on clupeoid fishes of the world recently published (Whitehead, 1985)

3/ See Whitehead (1985)

6.1.4 Anchovies (Figure 6)

Anchovies are commonly distributed in the coastal waters of the region. The fish prefer a neritic environment and concentrate in nearshore waters, including estuarine areas. They are generally composed of several genera: *Coilia*, *Setipinna*, *Thryssa*, *Thrissina* and *Stolephorus*. Among 13 species of *Stolephorus* found in the region, shorthead anchovy (*S. heterolobus*), and Indian anchovy (*S. indicus*) are considered the most important. Anchovies are highly abundant along northern Sumatra, Peninsular Malaysia, the east coast of Thailand, Kampuchea and Viet Nam. The fishing grounds are generally confined to the inshore waters along these coasts (Figure 6). The major fishing gear employed are liftnets, bagnets and small-scale purse seines with small mesh size.

Intensive studies have been made mostly on the genus *Stolephorus* in the Manila Bay, the Java Sea, the Strait of Singapore, the Malacca Strait and the Gulf of Thailand. The species studied so far include spotty-face anchovy (*S. bataviensis*[1]), Buccaneer anchovy (*S. buccaneeri*[2]), Commerson's anchovy (*S. commersonii*), shorthead anchovy (*S. heterolobus*[3]), Indian anchovy (*S. indicus*), Hardenberg's anchovy (*S. insularis* and *S. zollingeri*[4])(Table 2). However, a firm basis has not yet been established for the identification of several species as is shown in the footnote of this sub-section. Further study on this aspect, as well as other biological features of the fish, is urgently required.

The following literature refers specifically to anchovies in the region: Whitehead (in preparation) for the entire region, Tham (1974) for the South China Sea, Dhebtaranon (1973), Isara (1972), Sitthichokpun (1970), Supongpan *et al.* (1984) and Taweesith (1979) for the Gulf of Thailand, Tham (1953, 1967, 1967a) for the Singapore Strait and Tiews, Ronquillo and Santos (1970) for the Manila Bay. See Sections 2 and 6.1 for global and broader references.

6.1.5 Carangids[5] (Figure 7)

The carangids (excluding *Decapterus* spp., which have already been dealt with separately) are generally composed of a large number of genera and species in this region, 19 and 49 respectively. Among these, *Atule*, *Carangoides*, *Megalaspis*, *Scomberoides*, *Selar* and *Selaroides* are the most important groups of commercial value. Due to the involvement of so many species, the mixed catches and the difficulties in field identification of species, fishery statistics for this group have generally been compiled at the species combined level in many countries. Torpedo scad[6] (*Megalaspis cordyla*) is the only species for which statistics have been separately compiled in all the countries concerned. In the geographic distribution of this group reviewed here, however, all carangid species have been combined and are shown in Figure 7.

Under these circumstances, the biological research carried out so far has been limited in terms of both the species examined and the areas surveyed, and applies to yellowtail scad (*Atule mate*), cleftbelly trevally[7] (*Atropus atropus*), malabar trevally[8] (*Carangoides malabaricus*), rainbow runner (*Elagatis bipinnulata*), torpedo scad[9] (*Megalaspis cordyla*), bigeye scad (*Selar crumenophthalmus*) and yellowstripe scad[5] (*Selaroides leptolepis*) in the Gulf of Thailand, Indonesia and Philippine waters (Table 2).

1/ Recently classified as, *Stolephorus waitei*[10]

2/ Recently classified as, *Encrasicholina punctifer*[10]

3/ Recently classified as, *Encrasicholina heteroloba*[10]

4/ Recently classified as, *Encrasicholina punctifer*[10], a synonym of the above. English name is therefore not given in this paper.

5/ The English names employed in this sub-section are tentative as FAO standard names (in preparation)

6/ Hardtail scad at present

7/ Kuweh trevally at present

8/ Malabar cavalla at present

9/ Yellowstripe trevally at present

10/ Reference, FAO species catalogue on clupeoid fishes of the world *FAO Fish.Synop.*, (125)Vol. 7, Pt. 2 (Whitehead, in preparation)

The following literature refers specifically to carangids in the region: Termvidchakorn (1983) and Tu (1971) for the South China Sea, Bhatia *et al*. (1979) and Druzhinin and Hliang (1972) for the Andaman Sea, Latiff *et al*. (1974) and Wahyuono *et al*. (1983) for the Malacca Strait, Naiyanetr (1963), Nupetch (1984), Nupetch *et al*. (1983) and Piyathirathitivorakul (1983) for the Gulf of Thailand, Sudradjat and Nugroho (1983) for the Sunda Shelf and Arce (1981) for the Visayan Sea. See Sections 2 and 6.1 for global and broader references.

6.1.6 King mackerels (Figure 8)

In this group there are three species commonly found in the region: narrow-banded Spanish mackerel (*Scomberomorus commerson*), Indo-Pacific king mackerel (*S. guttatus*) and streaked seerfish (*S. lineolatus*). They are generally widely distributed in both inshore and offshore waters (Figure 8). The juvenile and small fish are often caught by trawl and bamboo stake trap in coastal waters while large fish are caught mainly by gillnet, troll and longline in offshore waters. Although the fish fetch a high market price due to the high demand in many of the countries, the quantity of the catch has remained rather small compared to the other fish groups in pelagic fish resources.

The biological research carried out so far has been limited to certain areas such as the Gulf of Thailand and the Visayan Sea (Table 2). It is believed that the fish migrate widely beyond the borders of national jurisdiction in both nearshore and offshore areas.

The following literature refers specifically to king mackerels in the region: Collette and Nauen (1983) for the entire region, Menasveta, Shindo and Chullasorn (1973) for the South China Sea, Boonragsa (1984) for the Andaman Sea, Chayakul *et al*. (1983), Chullasorn, Chatiyaputta and Chayakul (1973), Klinmuang (1979), Supongpan (1979) and Supongpan and Chayakul (1979) for the Gulf of Thailand, Uktolseja *et al*. (1979) for Indonesia, Chung and Chiu (1980) for Hong Kong and Ingles and Pauly (1984) for the Philippines. See Section 2 for global references.

6.1.7 Coastal tunas (Figure 9)

The coastal tunas in the region include mostly kawakawa (*Euthynnus affinis*), frigate tuna (*Auxis thazard*) and longtail tuna (*Thunnus tonggol*). They are abundant and are widely distributed almost over the whole region (Figure 9). Until recently, these fish were caught only incidentally in the waters around the Philippines, Indonesia, Malaysia and Thailand. Being stimulated by the strong demand for the canning industries, which have developed rapidly in recent years, fishing on coastal tunas has become one of the important commercial fisheries in these waters. Although the resources are believed to be abundant over the entire region, fishing has not been well developed in the other areas. Further expansion is therefore quite feasible in many coastal and offshore waters of the region.

Knowledge on the biology of these species is limited mostly to the Gulf of Thailand and partly to the Philippine waters (Table 3).

The following literature refers specifically to coastal tunas in the region: Collette and Nauen (1983) and Uchida (1981) for the entire region, Kikawa and Ferraro (1967) for Indian Ocean, Kume (1973) for the South China Sea, Bhatia and Boonragsa (1980), Boonragsa (1984) and Yesaki (1982) for the Andaman Sea, Chayakul *et al*. (1983), Chiampreecha (1978), Cheunpan (1984), Klinmuang (1978, 1981) for the Gulf of Thailand, Dwiponggo and Pauly (in press) and Uktolseja *et al.* (1979) for Indonesia, Ingles and Pauly (1984) and Ronquillo (1963) for the Philippines. See Section 2 for global references.

6.2 Demersal fish

Demersal fish in Southeast Asia comprise numerous species and many of them have been commercially harvested. For instance, along the Thai and the Malaysian coasts of the Gulf of Thailand, approximately 30 families of demersal fish exist, of which more than 300 species have been commercially utilized (Wongratana, 1968).

It is a distinctive feature of the demersal fisheries in the region that a substantial amount of small-size fish of no commercial value are usually caught together with larger fish of commercial value (Meemeskul, 1982; Shinoda, 1978). It is usually dealt with as "trash fish" by the fishermen, and accounts sometimes for more than 50 percent of the total catch, especially in the Gulf of Thailand. Trash fish comprise three different species groups: non-edible species unacceptable by the fish market, edible species of low commercial value and juveniles of commercially important larger species. The third category is of importance for assessment and management purposes as it can account for more than 30% of the total trash fish catch (Shinoda, Lim and Tan 1978). However, this involves many highly complicated problems in conjunction with the multispecies nature of the resources (Shinoda *et al*., 1979), and no immediate solution can be expected, as discussed in the later part of this paper. Trash fish are generally discarded at sea immediately after sorting out on board. In a few countries, they are processed as fish meal for animal feed and as fish sauce for human consumption.

Demersal fish are generally abundant on the shallower part of continental shelves with a depth range of 10-60 m. Trash fish generally occur on further shallower shelves between 10 and 30 m deep.

The mapping of the geographic distribution of demersal fish has been made for the eight major species groups commonly found in the region: pony fish (Leiognathidae, Figure 10), red snappers (Lutjanidae, Figure 11), goat fish (Mullidae, Figure 12), threadfin breams (Nemipteridae, Figure 13), bigeye snappers (Priacanthidae, Figure 14), groupers (Serranidae, Figure 15), croakers (Sciaenidae, Figure 16) and lizardfish (Synodontidae, Figure 17).

In addition to the references mentioned in the following sub-sections on each of the species groups, a number of publications refers to multiple species groups on a broader basis. See also Section 2 for global references.

(1) Resource assessment:

SCSP (1978a) for the South China Sea and SCSP (1976, 1976a) for the Malacca Strait.

(2) Multispecies resources assessment:

Pauly and Murphy (1982) for the tropics in general, Pauly (1979) for Southeast Asia, Shinoda *et al*. (1979) for the South China Sea with special emphasis on the selectivity of mesh-size, and Ritragsa (1976) for the Gulf of Thailand.

(3) Resources and fisheries (general):

Aoyama (1973), Shindo (1973) for the South China Sea, Druzhinin and Hliang (1972) for Burma, Chantawong *et al*. (1984) for the Andaman Sea, Wahyuono *et al*. (1983) for the Malacca Strait, Fisheries Research Institute, Malaysia (1984) for Malaysia, Chua and Mathias (1975) for West Sabah, Malaysia, Isarankura (1968) and Menasveta (1980) for the Gulf of Thailand, SCSP (1977a, 1977b), for the Sunda Shelf, Departmen Pertanian, Indonesia (1983) for Indonesia, Sujastani (1983) for Sumatra, SCSP (1979) for the Java Sea, Lai-shing (1968) for Hong Kong, SCSP (1976b) for the Visayan and Sibuyan Seas, SCSP (1977) for the Sulu Sea, the Bohol Sea and the Moro Gulf, SCSP (1978b) for the Pacific coast of the Philippines and SCSP (1979a) for West Luzon.

(4) Resources Research:

Kyokuyo Co.Ltd. (1972) for the South China Sea, Latiff *et al*. (1974), Pathansali *et al*. (1974) and Pong (1981) for the Malacca Strait, Aglen *et al*. (1981) for Malaysia, Pong *et al*. (1976) for West Sarawak, Wongratana (1968) for the Gulf of Thailand, Saeger *et al*. (1976) and Widodo (1976) for Indonesia.

(5) Resources and biology (general):

Nguyen (1972) and Tu (1971) for the South China Sea, Meemeskul (1978), Pramokechutima (1978) and Ritragsa, Dhamniyon and Sitthichaikasem (1968) for the Gulf of Thailand, Dwiponggo and Pauly (in press) for Indonesia, Martosubroto (1982) for the Java Sea, and Ingles and Pauly (1984) for the Philippines.

(6) Resources/fisheries/biology of trash fish:

Shinoda, Lim and Tan (1978), Shinoda *et al*. (1979) for the South China Sea and Meemeskul (1982) for the Gulf of Thailand.

6.2.1 Pony fish, Leiognathidae (Figure 10)

There are two genera in this group occurring in the region: *Leiognathus* and *Gazza*. The former genus predominates over the latter in terms of the number of species involved as it consists of about 20 species and their abundance. Among them *L. bindus*, *L. blochii*, *L. brevirostris*, *L. equulus* and *L. splendens* are very common in the region. They occur in large quantity in shallow waters along the coast throughout the region and are caught mainly by trawl (Figure 10). In the Java Sea the catch of *L. splendens* accounts for the largest component of the total catch by liftnet.

Biological studies have been carried out for several species of *Leiognathus* in various waters such as the Manila Bay, the Samar Sea, the Java Sea, the Malacca Strait and the Gulf of Thailand. Results of these studies are shown in Table 4.

The following literature refers specifically to pony fish in the region: Amaragsa (1968) and Vadhanakul (1976) for the Gulf of Thailand and Tiews *et al*. (1972) for Manila Bay and San Miguel Bay. See Sections 2 and 6.2 for global and broader references.

6.2.2 Red snappers, Lutjanidae (Figure 11)

There are four genera occurring in the region: *Lutjanus*, *Pristipomoides*, *Caesio*[1] and *Glabrilutjanus*[2]. However, *Lutjanus* is the most important as it is composed of 24 species. Among those species *L. argentimaculatus*, *L. johni*, *L. lineolatus*[3], *L. malabaricus*, *L. sebae*, *L. sanguineus* and *L. vitta* are commonly found in commercial catches. They are distributed widely over the areas but a larger concentration is found in offshore waters in the South China Sea deeper than 60 m (Figure 11). There may be similar concentrations in deeper waters in other areas where further expansion of fishing would be feasible. This may be most likely on the deeper and untrawlable ground, where demersal resources have never been heavily fished, if suitable fishing methods are introduced.

Biological features have been studied for four species collected from the Strait of Malacca, the South China Sea (Hong Kong, Malaysia, Singapore), the Gulf of Thailand, the Andaman Sea and the northern Java Sea (Table 4).

The following literature refers specifically to red snappers in the region: Allen (1985) for the entire region, Kangvankij (1970) for the South China Sea, Intong (1980) for the Gulf of Thailand, and Gafa and Sadhotomo (1983) for South Kalimantan. See Sections 2 and 6.2 for global and broader references.

6.2.3 Goat fish, Mullidae (Figure 12)

Goat fish in the region are composed of three genera and 14 species. The most common genus is *Upeneus*, in which three species are commonly found in commercial catches: *U. bensasi*, *U. moluccensis* and *U. sulphureus*. They are distributed widely in both the coastal and offshore waters. However, they tend to be more abundant in deeper waters. The geographic distribution is given in Figure 12.

Knowledge on the biological features of the fish is limited to a few specific areas: the South China Sea (Hong Kong), the Java Sea and the Philippine waters (Table 4).

The following literature refers specifically to goat fish in the region: Badrudin (1978a) for the Java Sea and Lee (1974) for Hong Kong. See Sections 2 and 6.2 for global and broader references.

6.2.4 Threadfin breams, Nemipteridae (Figure 13)

Three genera have been reported from the region, namely *Nemipterus*, *Scolopsis* and *Parascolopsis*. The first genus is the most important in terms of quantity and commercial value. The total number of species occurring in each of the genera are 20, 11 and 2 respectively. The important species of the genus *Nemipterus* include *N. hexodon*, *N. japonicus*, *N. marginatus*, *N. nematophorus*, *N. peronii* and *N. nemurus*. Besides these, *Scolopsis taeniopterus* is also common in the commercial catch. Threadfin breams are most abundant at the intermediate depth zone ranging from 30 to 60 m (Figure 13).

It is to be noted that 10 species of this group have been studied so far, which is a relatively larger number in comparison with the other demersal fish groups studied. However, detailed research has been limited to the Gulf of Thailand (Table 4).

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[1] Recently classified mostly as *Paracaesio* spp. and partly as *Pinjalo* spp.[4]

[2] Recently classified as *Symphorus* spp.[4]

[3] Recently classified as *Lutjanus lutjanus*[4]

[4] Reference FAO Species Catalogue on snappers of the world. *FAO Fish.Synop.*, (125)Vol.6:208 (Allen, 1985)

The following literature refers specifically to threadfin breams in the region: Boonwanich (1980, 1981) for the Andaman Sea, Amornchairojkul *et al.* (1982), Isarankura and Pariyanond (1963), Rugvichai (1977), Thumnyom and Charnprasertporn (1977), Vadhanakul (1980, 1981) for the Gulf of Thailand, Weber *et al.* (1977) for east Malaysian waters, Pauly and Martosubroto (1980) for the western Kalimantan waters and Arce (1981) for the Visayan Sea. See Sections 2 and 6.2 for global and broader references.

6.2.5 Bigeye snappers, Priacanthidae (Figure 14)

There is only one genus in this group comprising three species, two of which are of high commercial value: *Priacanthus tayenus* and *P. macracanthus*. The first species is more abundant than the second. Bigeye snappers are distributed widely over the region, but large concentrations are usually found at the intermediate depth zone ranging from 30 to 60 m. They are occasionally found in large concentration in deeper zones, but only in certain areas (Figure 14).

Many biological features of this group have been relatively well studied. It is notable that information for *P. tayenus* is available mostly in the Gulf of Thailand while that for *P. macracanthus* is only in the Java Sea (Table 4), a situation that needs future clarification of the reasons involved, particularly regarding their distribution patterns in the entire region.

The following literature refers specifically to bigeye snappers in the region: Chomjurai (1970) and Wetchagarun (1971) for the Gulf of Thailand and Nugroho *et al.* (1983) for the Java Sea. See Sections 2 and 6.2 for global and broader references.

6.2.6 Groupers, Serranidae (Figure 15)

This group is represented by nine genera and 42 species in the region. The genus *Epinephelus* is considered to be the most important in terms of abundance and commercial value. There are 21 species of *Epinephelus* in the region, four of which - *E. awoara*, *E. megachir*, *E. sexfasciatus* and *E. tauvina* - are commonly found in the commercial catch. The distribution pattern is variable by species and appears to be rather random, lacking a consistent relationship between abundance and depth of habitat (Figure 15).

Information on the biological features of this group is very limited in terms of both the number of species examined and the localities surveyed (Table 4). It is hoped that more extensive studies will be undertaken in the near future to meet industrial requirements as the importance of these species for mariculture material is rapidly growing in many countries in the region.

The following literature refers specifically to groupers in the region: Tan (1974) and Tan and Tan (1974) for the South China Sea, and Intong (1980a) for the Gulf of Thailand. See Sections 2 and 6.2 for global and broader references.

6.2.7 Croakers, Sciaenidae (Figure 16)

Fifteen genera of croakers have been reported in this region. However, the fish of commercial value are limited to a few genera and species. They are composed mostly of *Johnieops sina*, *J. dussumieri*, *Otolithes ruber*[1] and *Pennahia macrocephalus* (Table 1) and are generally abundant in shallow waters down to 30 m deep (Figure 16).

Information on the biological features of the fish is very limited. This is due mostly to their lesser commercial value although substantial amounts are usually being landed. The fish in the Gulf of Thailand have only been intensively studied for various biological items (Table 4).

Only Phettongkam and Thasananukulkuj (1972) refer specifically to croakers in the region. See Sections 2 and 6.2 for global and broader references.

6.2.8 Lizardfish, Synodontidae (Figure 17)

Lizardfish in the region is represented by only one genus, *Saurida*. Among nine species found in region, the two are of high commercial value: *S. wanieso*[2] and *S. undosquamis*. They are distributed widely in both shallow and deep waters, but the largest concentration is usually formed around the intermediate depth zone at about 30-60 m (Figure 17).

[1] A synonym, *Otolithes argenteus*

[2] A synonym, *Saurida tumbil*

Information on biological features of this group has been collected from relatively many areas in the region. However, detailed studies have only been made for the Gulf of Thailand and Manila Bay (Table 4).

The following literature refers specifically to lizardfish in the region: Boonwanich and Amornchairojkul (1982) for the Andaman Sea, Charnprasertporn (1979), Chomdej (1966), Intong (1971, 1976), Meemeskul and Boonwanich (1982) and Shinoda and Intong (1977) for the Gulf of Thailand, and Tiews, Mines and Ronquillo (1972) for the Philippines. See Sections 2 and 6.2 for global and broader references.

6.3 Shrimps[1] (Figure 18)

The most important groups of shrimp resources in the region are Penaeus and Metapenaeus spp. It should be noted that about 70 percent of the total shrimp catch are caught in a mixture of several species. The common and commercially important species include banana prawn (Penaeus merguiensis), Indian white prawn (P. indicus), western king prawn (P. latisulcatus), giant tiger prawn (P. monodon), green tiger prawn (P. semisulcatus), Jinga shrimp, (Metapenaeus affinis), yellow shrimp (M. brevicornis), greasyback shrimp (M. ensis) and bird shrimp (M. lysianassa).

Besides these larger shrimps, small-size pelagic shrimps of the genus Acetes also occur abundantly over the entire region. They prefer the neritic environment and form dense shoals in the waters close to shore in specific areas and seasons. It should be noted here that the Western Central Pacific, including this particular region, is the most productive among the world oceans for pelagic shrimps. Major species traditionally harvested include northern mauxia shrimp (Acetes chinensis), Tsivakihini paste shrimp (A. erythraeus), Jawla paste shrimp (A. indicus), Taiwan mauxia shrimp (A. intermedius), akiami paste shrimp (A. japonicus), Alamang shrimp (A. sibogae) and Jembret shrimp (A. vulgaris). The global reviews on the biology and ecology of pelagic shrimps and the fisheries have been well documented by Omori (1974, 1975). However, too little attention has been paid so far by local institutes, and improvement is awaited as pelagic shrimps are very important not only for direct human consumption but also as food items in the fish communities in the region.

The shrimp resources as a whole are widely distributed throughout the region, but large concentrations are confined mostly to the nearshore waters especially where there is substantial discharge of fresh water (Figure 18).

Many research institutes in the region recently initiated intensive studies on the biology of commercially important species. These studies have focused mostly on several productive areas such as the Gulf of Thailand, Manila Bay, the Arafura Sea, the Java Sea and the waters along Brunei and East Malaysia. The information on biological features of various species acquired so far are given in Table 5.

In addition to the global, references mentioned in Section 2 of this paper, the following literature refers specifically to shrimps in the region.

(i) Overview

(1) Resources and fisheries:

Mistakidis (1973) and SCSP (1980) for the South China Sea, Kungvankij et al. (1973a) for the Andaman Sea, Vibhasiri (1984) for the Gulf of Thailand, Weng (1978) for Malaysia, Simpson and Chin (1978) for Sabah, Malaysia and Naamin (1984) for the Arafura Sea.

(2) Biology in general:

Holthuis (1980) for the entire region, Chaitiamvong (1980) and Vibhasiri and Kongmuang (1976, 1976a) for the Gulf of Thailand, Dwiponggo and Pauly (in press) for Indonesia, Currie (1982) for the Burnei estuary, and Tiews, Bravo and Ronquillo (1972) for Manila and San Miguel Bays.

(3) Spawning and larvae:

Kungvankij (1973) for the Andaman Sea, Pathansali et al. (1974) for the Malacca Strait, Thubtimsang (1977), Thubtimsang and Meechukhan (1976) and Thubtimsaeng (1978, 1978a) for the Gulf of Thailand and Martosubroto (1977) for the Java Sea.

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[1] The English and scientific names employed in this sub-section are those defined in FAO species catalogue on shrimps and prawns of the world (Holthuis, 1980)

(ii) Specific species groups

(1) *Penaeus* spp.

Chaitiamvong and Thaiprayoon (1978) and Hutasing (1974) for the Gulf of Thailand, Badrudin (1978) for northwest Sumatra, Martosubroto (1977) for northwest Java, Adisusilo (1983) for Cilicap, Indonesia, and Sumiono (1983) and Naamin (1984) for Irian Jaya, Indonesia.

(2) *Metapenaeus* spp.

Chaitiamvong and Thaiprayoon (1977, 1978a, 1979) and Chaitiamvong and Phunwichian (1980) for the Gulf of Thailand.

(3) *Acetes* spp.

Omori (1974, 1975) for the entire region and Chaitiamvong (1980a) for the Gulf of Thailand.

6.4 Cephalopods[1/] (Figures 19 and 20)

The important cephalopod resources in the region are squids and cuttlefishes. Less attention has been given to the utilization of octopuses either by fishermen or consumers. Among these groups, four species of squids (Indian squid, *Loligo duvauceli*; swordtip squid, *L. edulis*; mitre squid, *L. chinensis*; and bigfin reef squid, *Sepioteuthis lessoniana*) and two species of cuttlefish (pharaoh cuttlefish, *Sepia pharaonis*; and curvespine cuttlefish, *S. recurvirostra*) are commonly found in commercial catches. They are widely distributed in both coastal and offshore waters (Figures 19-20).

Although squids and cuttlefish are generally considered to have acquired both the pelagic and demersal life forms, they are mainly caught by trawl in the region, which means that the pelagic form has been scarcely utilized. The recent development of dipnet and mid-water trap squid fishing in the Gulf of Thailand is to be noted in this regard, as it uses the pelagic form of squids in offshore waters.

Information on the biology of these resources in the region is scanty and limited to the Gulf of Thailand. They are summarized in Table 6.

In addition to the global references mentioned in the Section 2 above, the following literature refers specifically to cephalopods in the region.

(1) Overview:

Chikuni (1983) and Roper, Sweeney and Nauen (1984) for the entire region, Cholatarn (1978), Supongpan (1984) and Supongpan and Kongmuag (1976, 1976a) for the Gulf of Thailand.

(2) Squids:

Chotiyaputta (1982) for the Gulf of Thailand and Latiff (1982) for Malaysia.

(3) *Loligo* spp.:

Rattanaanun (1977, 1980) for the Gulf of Thailand and Marzuki (1983) and Marzuki *et al.* (1983) for Lombok, Indonesia.

7. DISCUSSION

It is recognized that the major fishing grounds for many important resources are widely spread out in the coastal waters of the region (Figures 3 to 20). However, intensive fishing is generally concentrated in nearshore waters shallower than 60 m deep. Fishing on some stocks like coastal tunas and king mackerels extends, on the other hand, further to offshore waters. Some demersal fish in deeper waters are also exploited on coral reefs, but the deeper parts of continental shelves generally remain unused. It is thought that the concentration of fishing in many nearshore waters in the region may be the result of the small-scale nature of the local fisheries, which depend strongly on the coast or shallower sea bottom. The availability of resources decreases, as

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[1/] The names employed refer to FAO species catalogue on cephalopods of the world (Roper, Sweeney and Nauen, 1984) a matter of course, with increases in sea depth. However, this may not be the critical limiting factor on the expansion of fishing ground further offshore. It is believed accordingly that substantial amounts of both demersal and pelagic fish would be taken even in the offshore waters in the region where no intensive fishing has been attempted so far.

The results of a few exploratory fishing trials in offshore waters carried out in the past indicate the abundant distribution of some demersal fish stocks on the deeper part of the continental shelves. They include red snappers, groupers and threadfin breams. There may be substantial demersal fish stocks in the other offshore areas where such trials have not been made. The results of larval survey also suggest the substantial distribution of pelagic fish resources in offshore waters (Vattanachai, 1974; Termvidchakorn, 1983). In this regard, further research and studies are strongly recommended, and particularly on the relationship between inshore and offshore stocks.

As was stated in the introductory part of this paper, the geographic distribution maps presented here were prepared on a species group basis combining the information on major species in each group together. Each illustration looks like a very broad distribution over the region without any disruption or separation of the stocks. However, it is known that the distribution range generally differs substantially by species in each of the species groups referred to, as is the case for those in the Gulf of Thailand (Pramokechutima, 1978). The species composition of existing resources and of commercial catches therefore vary greatly by area. It is also well known that many species in the region are composed of several different stocks (FAO/SEAFDEC, 1985). In this regard data collection should be intensified in the future to examine the range and pattern of the distribution of specific stocks.

Another constraint is the lack of a firm basis for the species identification of many species. This is due first to the tropical nature of the resources, i.e., multispecies with lesser morphometric variation, and second to the insufficiency of the research activities carried out so far in the region. Even if the fish are limited to a few commercially important species, e.g., Decapterus spp., concensus on the species identification of their scientific names has not yet been established in the region, as was discussed at the FAO/SEAFDEC Workshop on shared stocks in Southeast Asia (FAO/SEAFDEC, 1985). It is extremely difficult to improve the situation in the immediate future due to the complexity of the subject and to the necessity of difficult work. However, the importance of continuous and intensive research and study on this particular subject needs to be re-emphasized.

A lot of biological information was summarized in this paper for a large number of species (Tables 2-6). However, a gap in the knowledge still remains in terms of the coverage of both the subjects and localities in the region. Although various intensive studies were carried out for several important stocks, they concentrated generally on a few limited areas. Knowledge is still seriously lacking in many areas, especially for the central to eastern and northern parts of the region. It is recommended that more attention be paid to the biological research of the resources, and particularly of commercially important stocks. These include mackerels, round scads, sardines, carangids, coastal tunas and shrimps. Similar activities should be expanded to the resources that have not yet been intensively harvested, but which are believed to become very important in the near future. These may include anchovies, squids, cuttlefish and octopuses.

Among the many biological items, growth, mortality, feeding habit and spawning season have been relatively intensively studied. However, the data are generally limited to the western part of the region, the Gulf of Thailand, the Malacca Strait and the Java Sea. Furthermore, spawning ground, first maturity and life span, which are also very important parameters for assessment purposes, have not been intensively studied. It should be noted again that knowledge on these features in the central to eastern and northern parts of the region remains meager and the importance of future study needs to be emphasized.

It is to be noted that the magnitude and quality of the studies vary according to the area surveyed. This may be the result of many factors including the complexity of the environment and the resources in the areas surveyed, sampling techniques and the method of analysis employed, etc. It is hoped, in this regard, that knowledge on the biology of important resources will be obtained for the entire region, first on a well-balanced basis for geographic coverage and second on a compatible basis in terms of the minuteness and preciseness among the areas/institutes concerned. It is expected that this paper will be useful as a guidepost in this respect.

The information on the migratory patterns of pelagic fish is also very sparse and fragmentary. Although the available information has been compiled and given in Figure 21, it is very tentative for the reasons mentioned above. Through tagging experiments carried out by the research institute in Thailand, the Indo-Pacific mackerel (Rastrelliger brachysoma) was confirmed to migrate seasonally in the Gulf of Thailand. The experiments also suggest that a fairly demarcated range of the distribution of the fish exists in the Gulf, from the inner part to the northwest coast, which falls entirely in Thai jurisdictional waters. The fish in the Malacca Strait, on the other hand, migrate seasonally across the jurisdictional border between Thailand and Malaysia. There are many stocks in the other waters of the region that show short-distance migration and displacement within local waters in conjunction with spawning and feeding. These include anchovies in Manila Bay and the Strait of Singapore; sardines in Manila Bay, the Samar Sea and the Bali Strait; many demersal fish in the waters off Sarawak and Peninsular Malaysia and the northwestern part of the South China Sea. Shrimps in the Brunei Bay show a similar displacement pattern, and the same is probably true for the many other shrimp stocks in the region.

The distribution and migration patterns of fish sometimes raise further complicated problems in harvesting and managing these resources as shared stocks in both the migratory and non-migratory as well as the "transboundary" modes. This has become one of the focal points of resource management for all the countries in the region since national jurisdiction was extended to 200 miles. In fact, there are probably at least 40 stocks currently being shared by two or more countries as identified at the FAO/SEAFDEC Workshop on shared stocks in Southeast Asia (FAO/SEAFDEC, 1985). The biological aspects of these stocks were discussed and the major direction of future research was clarified at the Workshop. The principal requirements for the research of shared stocks are quite identical to those for stock assessment in general. However, the priority areas specifically identified were the geographic limits of distribution, migration and displacement and the location and timing of spawning. Improvement in the quality and timeliness of fishery statistics is another essential issue to be tackled in the immediate future, as was also discussed at the Workshop. It is hoped, in this regard too, that this paper will stimulate an improvement in research in the region.

The strengthening of international cooperation among the institutes and the scientists concerned should also be pursued. Collaboration in research and study, including frequent and close communication, would undoubtedly push forward not only resources appraisal and management but also marine sciences in general for the region.

Finally, apart from the intra-species biological features of important fish resources mentioned above, the importance of inter-species functions in the fish community, including those of trash fish, also needs to be emphasized. In the combination of multispecies resources and multigear fisheries, both distinctive features of this particular region, as was already mentioned, the species composition of the fish community in the region could easily be considerably changed. In fact, there have been several clear indications of this phenomenon in the demersal fish community in the Gulf of Thailand (Ritragsa, 1976; Pauly, 1979). It has generally been accepted by many scientists that the decline in the commercially important larger size finfish would have resulted in a substantial increase in the other species, e.g., cephalopods and smaller size trash fish. However, studies on these inter-species aspects of the fish community have scarcely been made so far due first to the lack of adequate information and second to the extremely high complexity of the subject and approach (Pauly and Murphy (eds.), 1982). This is a long-term target, and the scientists and institutes in the region need to keep this in mind for the future research.

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Table 1

Occurrence of major species groups and species in the region
(1) Coastal pelagic fish. See Section 4 for annotation and Sections 2 and 6.1 for references

Family and genus	Number of species involved in genus	Species of commercial value reported from countries										
		Species	Brunei	Burma	Hong Kong	Indonesia	Kampuchea	Malaysia	Philippines	Singapore	Thailand	Viet Nam
FAMILY CARANGIDAE												
Alectis	2											
Alepes	3	A. kalla		+	+						+	
Atropus	1	-										
Atule	1	A. mate		+	+	+	+	+	+		+	+
Carangoides	13	C. malabaricus		+	+			+		+	+	
Caranx	8	-										
Decapterus	8	D. macrosoma				+		+	+		+	
		D. maruadsi			+			+	+		+	
		D. russelli		+		+			+			+
Elagatis	1	-										
Gnathonodon	1	-										
Megalaspis	1	M. cordyla	+	+	+	+	+	+	+	+	+	+
Naucrates	1	-										
Scomberoides	4	S. lysan		+				+			+	
Selar	3	S. boop		+				+				
		S. crumenophthalmus	+	+	+	+	+	+	+	+	+	+
		S. malam		+							+	
Selaroides	1	S. leptolepis	+	+	+	+	+	+	+	+	+	+
Seriola	2	-										
Seriolina	1	S. nigrofasciata		+				+			+	
Trachinotus	3	-										
Trachurus	1	T. japonicus			+							
Ulva	1	-										
FAMILY CLUPEIDAE												
Anodontostoma	2	-										
Dussumieria	1	D. acuta				+		+	+		+	+
Escualosa	1	-										
Herklotsichthys	2	-										
Hilsa	4	-										
Ilisha	5	-										
Nematalosa	3	-										
Opisthopterus	1	-										
Pellona	1	-										
Raconda	1	-										
Sardinella	11	S. fimbriata		+		+		+	+		+	
		S. gibbosa		+		+					+	
		S. leiogaster							+		+	+
		S. longiceps				+						
Ambligaster		A. sirm				+			+		+	
Spratelloides	2	-										
FAMILY ENGRAULIDAE												
Coilea	5	-										
Setipinna	8	-										
Stolephorus	13	S. heterolobus	+	+	+	+	+	+	+	+	+	+
		S. indicus	+	+	+	+	+	+	+	+	+	+
Thrissina	1	-										
Thryssa	8	-										

Table 1 (1) (continued)

Family and genus	Number of species involved in genus	Species of commercial value reported from countries										
		Species	Brunei	Burma	Hong Kong	Indonesia	Kampuchea	Malaysia	Philippines	Singapore	Thailand	Viet Nam
FAMILY SCOMBRIDAE												
Acanthocybium	1	-										
Auxis	2	A. thazard	+	+	+	+	+	+	+	+	+	+
Grammatorcynus	2	-										
Gymnosarda	1	-										
Euthynnus	1	E. affinis										
Rastrelliger	3	R. brachysoma	+	+	+	+	+	+	+	+	+	+
		R. kanagurta	+	+	+	+	+	+	+	+	+	+
Sarda	2	-										
Scomber	2	-										
Scomberomorus	5	S. commerson	+	+	+	+	+	+	+	+	+	+
Thunnus	5	T. tonggol	+	+	+	+	+	+	+	+	+	+

Table 1 (continued)

(2) Demersal fish. See Section 4 for annotation and Sections 2 and 6.2 for references

Family and genus	Number of species involved in genus	Species of commercial value reported from countries										
		Species	Brunei	Burma	Hong Kong	Indonesia	Kampuchea	Malaysia	Philippines	Singapore	Thailand	Viet Nam
FAMILY LEIOGNATIDAE												
Gazza	1	G. minuta		+		+		+	+			
Leiognathus	20	L. bindus		+		+		+	+		+	
		L. blochii							+		+	
		L. brevirostris			+	+			+		+	
		L. equulus		+		+		+	+		+	+
		L. splendens		+		+			+		+	+
Secutor	2											
FAMILY LUTJANIDAE												
Lutjanus	24	L. argentimaculatus		+							+	+
		L. johni		+		+			+		+	
		L. lineolatus				+		+			+	
		L. malabaricus		+	+	+	+	+	+	+	+	
		L. sebae	+			+					+	
		L. sanguineus		+		+						+
		L. vitta				+	+		+		+	
Pristipomoides	4	P. typus									+	
Casio	7	-		+		+			+			
Glabilutjanus	1	-										
FAMILY NEMIPTERIDAE												
Nemipterus	20	N. hexodon				+		+	+		+	
		N. japonicus		+				+	+		+	+
		N. nematophorus				+		+			+	
		N. peronii				+		+			+	
		N. nemurus				+		+				
Scolopsis	11	S. taeniopterus				+		+			+	
Parascolopsis	2	-										

Table 1 (2) (continued)

Family and genus	Number of species involved in genus	Species of commercial value reported from countries										
		Species	Brunei	Burma	Hong Kong	Indonesia	Kampuchea	Malaysia	Philippines	Singapore	Thailand	Viet Nam
FAMILY SCIAENIDAE												
Bahaba	2	-										
Chrysochir	1	-										
Collichthys	2	-										
Dendrophysa	1	*D. russelli*				+		+	+		+	
Johnieops	3	*J. sina*				+		+				
		J. dussumieri		+				+			+	
Johnius	6	-										
Kathala	1	-										
Nibea	4	-										
Otolithes	4	*O. argenteus*		+							+	+
Otolithoides	2	-										
Panna	1	-										
Pennahia	4	*P. macrocephalus*							+		+	
Protonibea	1	-										
Pterololithes	2	-										
Pseudosciaena	1	-										
FAMILY PRIACANTHIDAE												
Priacanthus	3	*P. macracanthus*		+	+	+					+	
		P. tayenus	+	+	+	+	+	+	+	+	+	+
FAMILY MULLIDAE												
Upeneus	7	*U. bensasi*						+			+	+
		U. moluccensis			+				+		+	
		U. sulphureus		+		+			+		+	
Mulloidichthys	1	-										
Parupeneus	6	-										
FAMILY SERRANIDAE												
Cephalopholis	8	-										
Cromileptes	1	-										
Epinephelus	21	*E. awoara*			+						+	
		E. megachir						+			+	
		E. sexfasciatus						+	+		+	+
		E. tauvina			+	+			+		+	+
Plectopomus	5	-										
Promicrops	1	-										
Variola	3	-										
Serranus	1	-										
Anyperodon	1	-										
Aethaloperca	1	-										
FAMILY SYNODONTIDAE												
Saurida	9	*S. tumbil*		+				+	+		+	+
		S. undosquamis				+		+	+		+	

Table 1 (continued)

(3) Shrimps. See Section 4 for annotation and Sections 2 and 6.3 for references

Family and genus	Number of species involved in genus	Species of commercial value reported from countries										
		Species	Brunei	Burma	Hong Kong	Indonesia	Kampuchea	Malaysia	Philippines	Singapore	Thailand	Viet Nam
FAMILY PENAEIDAE												
Penaeus	11	P. indicus		+			+	+	+		+	
		P. latisulcatus				+	+	+	+		+	
		P. merguiensis	+	+	+	+	+	+	+	+	+	+
		P. monodon				+	+	+	+		+	+
		P. semisulcatus			+	+	+	+	+		+	
Metapenaeus	14	M. affinis	+			+		+			+	
		M. brevicornis	+			+	+	+				
		M. ensis	+			+		+			+	
		M. lysianassa	+			+		+				
Parapenaeopsis	13	P. sculptilis	+			+		+				
Trachypenaeus	4	T. fulvus						+	+		+	
Metapenaeopsis	7	M. stridulans				+		+			+	
Atyopenaeus	2	-										
Parapenaeus	1	-										
Solenocera	3	S. subnuda	+			+		+				

Table 1 (continued)

(4) Cephalopods. See Section 4 for annotation and Sections 2 and 6.4 for references

Family and genus	Number of species involved in genus	Species of commercial value reported from countries										
		Species	Brunei	Burma	Hong Kong	Indonesia	Kampuchea	Malaysia	Philippines	Singapore	Thailand	Viet Nam
FAMILY LOLIGINIDAE												
Loligo	4	L. duvauceli			+	+		+	+		+	
		L. edulis			+	+		+	+			
		L. chinensis			+	+					+	+
Sepioteuthis	2	S. lessoniana			+						+	+
Symplectoteuthis	1	-										
Cranchia	1	-										
Doryteuthis	1	-										
Nototodarus	1	-										
FAMILY SEPEIDAE												
Sepia	8	S. pharaonis							+		+	
		S. recurvirostra							+		+	
Sepiella	2	-										
FAMILY OCTOPODIDAE												
Octopus	5[a]/	O. membranaceus									+	
		O. dollfusi									+	
Cistopus	1[b]/	-										

a/ Although three other species are believed to be widely distributed in the region (Chikuni, 1983, Roper, Sweeney and Nauen (1984), much attention has not been paid by fishermen

b/ Cistopus indicus is also believed to be abundantly distributed in the region (Ibid.), but neither academic nor industrial confirmation of this has been made

Table 2

Important biological features and parameters; coastal small pelagic fish in the region
(1) Mackerels. See Sections 5 and 6.1.1 for annotations and broader references

(Body size refers to total length unless specified as FL: fork length or SL: standard length; sexes are combined unless specified as M: male or F: female)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY SCOMBRIDAE Rastrelliger brachysoma	Gulf of Thailand[a]	20–40	15.0	20.95	10–40 mi off Pranchuat Surattani	2–4, 6–8	egg = $9x10^{-8}$ $L^{4.8356}$ 200 000–500 000, 20 000–30 000/ batch	10.25	1–3, 7–9	17.5	1:1	k=0.33	Z=1.06	2–3	Phytoplanktons, zooplanktons	$W = 0.006138L^{3.215}$ $M:W = 0.000005732L^{3.1235}$ $F:W = 0.000006578L^{3.1235}$
	Andaman Sea[b] (Thailand)	-	17.5	-	Koh Yaò, Krabi	2–3, 8–9	30 000/ batch 97 250–241 832	9.5–12.5	4, 8–10	17.5	1:1.3	-	-	-	Phytoplanktons, zooplanktons, diatoms, copepods	$\text{Log } W = 1.8874 + 3.214 \text{ Log } L$
	North of Java[c]	-	-	22.92	-	6–10	-	-	-	17.3	1.3:1	k=0.19	Z=0.88	3–4	-	-
	Malacca Strait[d] (Malaysia)	-	-	19.6–20.1	-	10–12	20 000–30 000/ batch	10.0	1–3	18.5	-	k=0.36–0.44	M=0.38 Z=0.82	-	-	-
	Manila Bay[e]	-	-	34.0	-	6–2	11 300–119 300	-	-	15.0–16.0	-	k=1.1	M=1184 Z=4.27	-	-	-
	Samar Sea[f]	-	-	25.0	-	-	-	-	-	-	-	k=1.60	M=2.56 Z=4.49	-	-	-

[a] Boonprakob (1965, 1967, 1972); Tabtimtai (1968); Suchondhamarn *et al.* (1970); Somjaiwong *et al.* (1970); Suvapepun and Suwanrumpha (1970)

[b] Boonragsa *et al.* (1984); Bussarawitch (1984, 1984a, 1984b)

[c] Sujastani (1974)

[d] Pathansali (1961, 1967); Chong and Chua (1974)

[e] Ingles and Pauly (1984); Tan (1970)

[f] Ingles and Pauly (1984)

Table 2 (1) Mackerels (continued)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY SCOMBRIDAE *Rastrelliger brachysoma* (continued)	Andaman Sea[a] (Burma)	-	19.3FL	23.0FL	-	10-5	20 000-30 000/ batch	13.7FL	2, 5-6	-	1:1.7	-	-	-	-	-
R. kanagurta	Gulf of Thailand[b]	30-60	16.0	22.9	-	2-4, 7-8	200 000	11.0	5-6	18.6	1:1	-	-	2-3	Phyto-planktons, zoo-planktons, diatoms, copepods	M:W = $0.0000001958L^{3.7653}$ F:W = $0.0000009454L^{3.0375}$
	Andaman Sea[c] (Thailand)	-	-	19.2	-	12.2	25 000/ batch 94 495 263 178	13.0-14.0	5-12	18.67	1:0.93	-	-	-	Phyto-planktons, diatoms, zoo-planktons, crustaceans, dinoflagellates	-
	North of Java[d]	-	11.9-12.4	23.89	-	10-2, 6-9	200 000 500 000	18.8	-	19.0	1:1.1	k=2.78 k=1.63	Z=1.2 Z=0.58	3-4	Filamentous algae, zolina, ceratium	M:W = $1.35\times10^{-5}L^{2.9927}$ F:W = $2.16\times10^{-5}L^{2.9281}$
	Malacca Strait[e] (Malaysia)	-	16.75	-	-	All around 5-1, 11-4	20 000-30 000-batch	-	-	18.75	-	-	-	-	Phyto-planktons, crustaceans, copepods, decapods, dinoflagellates	-

a/ Druzhinin (1968)

b/ Vanichkul and Hongskul (1965); Boonprakob (1967); Tantiswetratana (1979)

c/ Boonragsa *et al.* (1984); Bussarawitch (1984)

d/ Sujastani (1974); Gafa (1982); Dwiponggo and Pauly (in press)

e/ Pathansali (1961, 1967); Chee (1980)

Table 2 (1) Mackerels (continued)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY SCOMBRIDAE R. *kanagurta* (continued)	Palawan waters[a]	-	-	28.0	-	-	-	-	-	-	-	k=1.55	Z=8.27 M=2.43	-	-	-
	Andaman Sea[b] (Burma)	-	20.47FL	-	-	9-5	-	14.0FL	6-7	-	1:1.39	-	-	-	-	-

a/ Ingles and Pauly (1984)

b/ Druzhinin (1968)

Table 2 (continued)

(2) Round scads. See Sections 5 and 6.1.2 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (montb)							
FAMILY CARANGIDAE *Decapterus macrosoma*	Manila Bay and Palawan waters[a]	50-90	M:17.7 F:17.6	25.0	Manila Bay to Palawan	11-3	67 000-106 200	7.0-8.0	2-3	-	1:0.99	0.56 cm/month	-	3-6	Crustaceans, zooplanktons, fish, molluscs	$W = 0.005639L^{3.167}$
	Java Sea[b]	-	-	25.4	-	-	-	17.6	-	-	-	k=0.98	Z=6.22	-	-	-
	Gulf of Thailand[c]	30-60	-	-	-	12-5	-	-	-	16.5	1:0.9	-	-	-	-	-

a/ Magnusson (1970); Tiews, Ronquillo and Caces-Borja (1970); Ronquillo (1974)

b/ Dwiponggo and Pauly (in press)

c/ Chullasorn and Yusukswad (1977)

Table 2 (2) Round scads (continued)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY CARANGIDAE *Decapterus maruadsi*	Gulf of Thailand[a]	30-70	13.2	23.1	Central Gulf	2-3, 7-8	38 000-515 000	5.5-6.5	1-2, 6-8	16.1	1:1.2	k=0.11 1-2 cm/month	-	2-3	crustaceans, copepods	$W = 0.00005L^{2.811}$
	Java Sea[b]	-	-	26.8	-	-	-	9-14.2	-	18.3	-	k=0.95-1.04	Z=3.5-4.79 M=1.3	-	-	-
	Malacca Strait[c] (Malaysia)	-	-	-	-	-	-	7.5	7	-	-	-	-	-	-	-
Decapterus russelli	Palawan waters[d]	36-180	M:16.72 F:16.5	33.0	Palawan to Manila	11-3 1-4	29 000-49 000	8.0-9.0	2-3	16.6	1:1.04	k=0.2 0.6 cm/month	Z=2.62	3-6	Zooplanktons, crustaceans, fish	$W = 0.0098L^{3.0152}$
	Java Sea[e]	-	-	26.8	-	-	20 000-84 000	14.6	-	-	-	k=1.09	Z=4.09	-	-	-

a/ Chullasorn and Yusukswad (1977); Chantarasri (1980); Cheunpan (1981)

b/ Sadhotomo *et al.* (1983); Atmadja (1982)

c/ Southeast-Asian Fisheries Development Centre (1982)

d/ Tiews, Ronquillo and Caces-Borja (1970); Magnusson (1970); Ronquillo (1974); Ingles and Pauly (1984)

e/ Dwiponggo and Pauly (in press)

Table 2 (4) Anchovies (continued)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coeffocient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY ENGRAULIDAE *Stolephorus indicus*	Malacca Strait[a] (Malaysia)	-	-	-	-	-	-	-	-	11.6-12.5	-	0.195 cm/ 100 days	-	-	Zoo-planktons, fish, squid larvae	-
	Singapore Strait[b]	-	-	19.0SL	-	-	-	-	-	12.0SL	-	k=0.7118 3.0 cm/ 42 days	-	-	Zoo-planktons	-
	Manila Bay[c]	-	M:11.8 F:11.6	14.6	-	All around	9 000-14 000	8.0	1-3, 9	9.0	1:1.04	k=1.08 3.8-4.0 cm/ year	Z=4.53		Zoo-planktons, phyto-planktons, fish larvae	-
Stolephorus insularis	Singapore Straight[a]	-	-	11.9SL	-	-	-	-	-	5.0SL	-	k=0.17	-	1	-	-
Stolephorus zollingeri	Manila Bay[d]	-	-	10.6	-	-	-	-	-	-	-	k=1.85	Z=12.0	-	-	-

[a] Tham (1967a)

[b] Tham (1953)

[c] Tiews, Ronquillo and Santos (1970); Ingles and Pauly (1984)

[d] Ingles and Pauly (1984)

Table 2 (continued)

(5) Carangids (excluding round scads, Decapterus spp.) See Sections 5 and 6.1.5 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY CARANGIDAE Atule mate	Gulf of Thailand[a/]	15–45	16.0	25.8	30 mi off Chumporn Nakorn	3–4	–	5.5–6.5	1–3, 6–9	–	–	0.8 cm/ k=0.107	–	2–3	–	–
	Malacca Strait[b/] (Malaysia)	10–50	16.0	28.0	–	–	–	–	–	–	–	–	–	–	–	–
Atropus atropus	Andaman Sea[c/] (Burma)	20–60	17.2	20.0	–	1	–	–	–	–	–	–	–	–	Fish	–
Carangoides malabaricus	Andaman Sea[c/] (Burma)	20–60	M:19.9 F:19.3	29.0	–	7–9	–	13.1	1	–	1:1.22	–	–	–	Fish crustaceans, squids	–
	Andaman Sea[d/] (Thailand)	20–60	14.7	–	–	All around 2–5, 8–9	–	10–11	1, 3, 7	19.5	1:1.08	–	–	–	–	$\log W = 4.2246 + 2.8884 \log L$
	Malacca Strait[e/] (Indonesia)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	M: $W = 0.2727L^{2.9844}$ F: $W = 0.0125L^{2.9135}$
	Malacca Strait[f/] (Malaysia)	18–45	15.2	–	–	–	–	–	–	–	–	–	–	–	–	–
	South China Sea[g/] (Singapore)	–	–	–	–	–	–	–	–	13.0	1:1.4	–	–	–	Fish	–
Elagatis bipinnulatus	Moro Gulf[h/]	–	–	97.5	–	–	–	–	7	13.0	1:1.4	k=0.6	Z=1.19 M=0.92	4–5	–	–

a/ Piyathirathitivorakul (1983_

b/ Aglen et al. (1981)

c/ Druzhinin and Hliang (1972)

d/ Bhatia et al. (1979)

e/ Wahyuono et al. (1983)

f/ Latiff et al. (1974)

g/ Tu (1971)

h/ Ingles and Pauly (1984)

Table 2 (5) (continued)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
Megalaspis cordyla	Gulf of Thailand[a]	20-50	22.0	28.8	-	12-5, 8-11	-	11.5-10.5	5, 9	-	1:0.8	1.2 cm/ month k=0.2	-	-	Fish, crustaceans	$W = 0.144L^{2.9785}$
	Andaman Sea[b] (Thailand)	-	-	34.2	-	3-4	-	15.2	9-12	28.0	1:1.24	-	-	-	-	-
Selar crumenophthalmus	Manila Bay[c]	-	-	36.5	-	-	-	-	-	-	-	k=0.89	Z=2.91 M=1.57	-	-	-
	Java Sea[d]	-	-	29.5	-	-	-	17.8	-	-	-	k=1.25	Z=5.56	-	-	-
	South China Sea[e] (Singapore)	-	-	-	-	-	82 000-141 000	-	-	-	1:0.76	-	-	-	-	-
	Gulf of Thailand[f]	30-60	20-25	-	-	-	-	10.0	-	19.4	1:1.3	-	-	-	-	-
Selaroides leptolepis	Manila Bay[c]	-	-	29.0	-	-	-	-	-	-	-	k=0.80	Z=2.76	-	-	-
	Visayan Sea[g]	20-140	3.5-18.5	19.5-23.0	-	8-9	-	3.5-6.0	1-3, 7, 10	M:15.2 F:15.4	1:0.93	k=1.15	Z=8.64	-	-	$W = 0.0063L^{3.19}$
	Gulf of Thailand[h]	20-50	12.0	19.2 21.0	-	All around 3, 7-8	-	4.0-5.5	6, 11	F:15.4	1:1.02	k=0.128	-	-	Zooplanktons, phytoplanktons, molluscs	$M{:}\text{Log } W = 3.257 \text{ Log } L^{-5.567}$ $F{:}\text{Log } W = 3.629 \text{ Log } L^{-6.369}$
	South China Sea[i] (Indonesia	30-40	-	18.6	-	-	-	10.8	-	-	1:1	k=1.1	-	-		$M{:}W = 0.0438L^{3.3065}$ $F{:}W = 0.0104L^{3.0429}$
	Java Sea[d]	-	-	25.4	-	-	-	17.6	-	-	-	k=0.8	Z=6.22	-	-	-

a/ Nupech *et al.* (1983); Supongpan *et al.* (1982)

b/ Bhatia *et al.* (1979)

c/ Ingles and Pauly (1984)

d/ Dwiponggo and Pauly (in press)

f/ Department of Fisheries, Thailand (1984)

g/ Ingles and Pauly (1984); Arce (1981)

h/ Naiyanetr (1963); Nupetch (1984)

i/ Wahyuono *et al.* (1983); Sudradjat and Nugroho (1983)

Table 3

Important biological features and parameters: king mackerels and coastal tunas in the region
(1) King mackerels. See Sections 5 and 6.1.6 for annotations and broader references

(Body size refers to total length unless specified as FL: fork length or SL: standard length; sexes are combined unless specified as M: male or F: female)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (montb)		Size (cm)	Season (month)							
FAMILY SCOMBRIDAE *Scomberomorus commerson*	Gulf of Thailand[a]	20-60	50.0	92.0	-	2-3, 6-9	500 000- 3 800 000	11.0- 21.0	3-5, 7-10	58.6	1:1.6	k=0.12 3.4 cm/ months	-	4-5	Fish, molluscs, crustaceans	$W = 0.01302L^{2.8843}$
	Visayan Sea[b]	-	-	49.0	-	-	-	-	-	-	-	k=0.7	Z=1.49 M=1.23	-	-	-

[a] Chullasorn, Chotiyaputta and Chayakul (1973); Supongpan and Chayakul (1979)

[b] Ingles and Pauly (1984)

Table 3 (continued)

(2) Coastal tunas. See Sections 5 and 6.1.7 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY SCOMBRIDAE Auxis thazard	Indonesia[a/]	-	-	51.5	-	-	-	23.6	-	-	-	k=1.0	Z=4.03	-	-	-
	Bohol Sea[b/]	-	-	47.0	-	-	-	-	-	-	-	k=0.73	Z=2.84	-	-	-
	Moro Gulf[b/]	-	-	63.5	-	-	-	-	-	-	-	k=0.72	M=1.28 Z=4.52	-	-	-
	Gulf of Thailand[c/]	20 ~	35.0	-	-	4-6, 8-9	-	19.0 27.0	8-11 2, 4-5	34.1	1:1	-	-	3-4	-	W = 0.00002L$^{2.99}$
	Andaman Sea (Thailand)[d/]	20 ~	33.5	44	-	2-3, 10-12	-	-	-	38.0	1:1.25	1.4 cm/ month k=0.45	-	3-4	-	W = 0.000011L$^{3.119}$
Euthynnus affinis	Gulf of Thailand[c/]	20 ~	37.0	-	-	1-3, 6-7	1 730 000	21.0 26.0	2-4, 6.12	37.5	1:1	-	-	-	-	W = 0.000015L$^{2.979}$
	Andaman Sea (Thailand)[d/]	20 ~	37.2	64	-	2-4, 9-11	-	-	-	46.0	1:1.3	k=0.63 1.2 cm/ month	4	-	-	W = 0.000015L$^{3.034}$
	Philippines[e/]	-	42	80	-	All around 4-7	-	-	-	-	-	-	-	-	-	-
Thunnus tonggol	Gulf of Thailand[c/]	20 ~	38.5	-	-	3-5, 7-12	1 400 000	22.0-26.0	1-2, 4-6	39.6	1:1	1.5 cm/ month	-	4	-	W = 0.000021L$^{2.979}$
	Andaman Sea (Thailand)[d/]	-	43.5	56	-	2-4, 8-9	-	-	9-12	44.0	-	1.4 cm/ month	-	4	-	W = 0.000022L$^{2.947}$

[a/] Dwiponggo and Pauly (in press)

[b/] Ingless and Pauly (1984)

[c/] Klinmuang (1978, 1981); Cheunpan (1984)

[d/] Yesaki (1982)

Table 4

Important biological features and parameters; demersal fish in the region
(1) Pony fish. See Sections 5 and 6.2.1 for annotations and broader references

(Body size refers to total length unless specified as FL: fork length or SL: standard length; sexes are combined unless specified as M: male or F: female)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY LEIOGNATHIDAE Gazza minuta	Honda Bay, Palawan[a]	-	-	17.5	-	-	-	5.5	-	-	-	k=0.97	Z=6.62 M=2.03	-	-	-
	San Miguel Bay[a]	-	-	14.0	-	-	-	-	-	-	-	k=1.1	Z=8.85 M=2.23	-	-	-
Leiognathus bindus	Manila Bay[b]	-	-	9.3	-	-	-	-	-	-	-	k=1.25	Z=5.35 M=2.88	-	Zoo-planktons, fish eggs and larvae, crustaceans	-
	Java Sea[c]	-	-	12.5	-	-	-	5.21	-	-	-	k=1.37	Z=8.36	-	-	-
	Gulf of Thailand[d]	10-50	5.1	11.0	-	5, 8-10, 12	-	3.0, 3.5, 5.0	1, 8, 7	-	-	0.4-0.5 cm/month	-	-	-	-
Leiognathus blochii	Manila Bay[b]	-	-	12.8	-	-	-	-	-	-	-	k=1.21	Z=4.87 M=2.58	-	Zoo-planktons, fish eggs and larvae, crustaceans	-
Leiognathus brevirostris	Gulf of Thailand[e]	10-50	M:10.0 F:10.5	M:12.0 F:13.5	-	All around 7-9, 11-2, 5	-	M:9.1 F:9.7	-	-	1:1	-	-	-	Zoo-planktons, fish eggs and larvae, crustaceans	-

a/ Ingles and Pauly (1984)

b/ Ingles and Pauly (1984); Tiews *et al.* (1972)

c/ Dwiponggo and Pauly (in press)

d/ Amaragsa (1968)

e/ Vadhanakul (1976)

Table 4 (1) (continued)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY LEIOGNATHIDAE *Leiognathus brevirostris* (continued)	Java Sea[a/]	-	-	12.0	-	-	-	7.1	-	-	-	k=0.95	Z=2.79	-	-	-
	Manila Bay[b/]	10-60	M:10.06 F:10.55	M:12.0 F:13.5	-	7-2, 10	-	M:8.0 F:8.5	2, 9	-	1:0.9	k=1.69	Z=12.0 M=3.07	-	Zooplanktons, fish eggs and larvae, crustaceans, molluscs	-
Leiognathus daura	Manila Bay[b/]	-	-	9.5	-	-	-	-	-	-	-	k=1.54	Z=8.1 M=3.24	-	Fish eggs, diatoms, copepods	
Leiognathus equulus	Andaman Sea (Burma)[c/]	20-60	M:15.3 F:16.6	22.0	-	6-9	-	11.1	9-1	-	1:0.6	-	-	-	-	-
	Java Sea[a/]	-	-	21.5	-	-	-	13.4	-	-	-	k=1.5	Z=5.68	-	-	-
	Samar Sea[b/]	-	-	24.8	-	-	-	-	-	-	-	k=1.28	Z=5.97 M=2.22	-	Benthic animals, fish eggs	-
Leiognathus hastatus	Manila Bay[b/]	-	15.5	22.0	-	1-9	-	-	-	-	1:0.6	-	-	-	Zooplanktons, fish eggs and larvae, crustaceans, molluscs	
Leiognathus leuciscus	Java Sea[a/]	-	-	13.5	-	-	-	4.76	-	-	-	k=1.8	Z=6.15	-	-	-
	Gulf of Thailand[d/]	-	7.0	12.0	-	1, 4, 6, 10	-	4.5-6.0	2, 3 8, 9	-	-	0.5-0.6 cm/month	-	-	-	-
	Manila Bay[b/]	-	7.0	12.0	-	1, 4 7, 10	-	4.5	2, 3 8, 9	-	-	k=1.3	Z=7.29	-	Diatoms, fish eggs, benthic animals	

Table 4 (1) (continued)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY LEIOGNATHIDAE *Leiognathus lineolatus*	Malacca Strait[a] (Indonesia)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$M:W = 0.0263L^{2.754}$ $F:W = 0.0668L^{2.412}$
	Gulf of Thailand[b]	10-50	-	-	-	10-6(6)	-	8.5, 7, 8	2, 4, 6	-	-	-	-	-	-	-
	Manila Bay[c]	-	-	11.1	-	-	-	-	-	-	-	k=1.22	Z=7.4 M=2.69	-	Diatoms, crustaceans	-
Leiognathus splendens	Java Sea[d]	-	-	16.9	-	-	-	6.23	-	-	-	k=1.1	Z=4.0	-	-	-
	Samar Sea[c]	-	-	15.0	-	-	-	-	-	-	-	k=0.72	Z=3.77	-	Crustaceans, diatoms, fish eggs	-
	Manila Bay[e]	-	-	12.6	-	-	-	-	-	-	-	k=0.74	Z=5.28 M=1.86	-	-	-
Leiognathus ruconius	Manila Bay[c]	-	M:16.6 F:17.2	M:21.0 F:21.0	-	All around (2, 8)	-	-	-	-	1:0.81	k=1.43 (1-2)	Z=9.54 M=3.21	-	Crustaceans, fish, molluscs, polychaeta	$\text{Log } W = 2.755 \text{ Log } L - 4.312$
Secutor insidiater	Manila Bay[c]	-	-	10.1	-	-	-	-	-	-	-	k=1.42	Z=7.02 M=3.04	-	Zooplanktons, diatoms, fish eggs, crustaceans	-

a/ Wahyuono *et al.* (1983)

b/ Vadhanakul (1976)

c/ Ingles and Pauly (1984); Tiews *et al.* (1972)

d/ Dwiponggo and Pauly (in press)

e/ Ingles and Pauly (1984)

Table 4 (continued)

(2) Red snappers. See Sections 5 and 6.2.2 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY LUTJANIDAE Lutjanus johni	South of Kalimantan[a] (Indonesia)	30-60	-	78.2	-	-	-	-	-	-	1.05:1	k=0.21	M=0.61	-	-	$W = 1.7353\times10^{-5}L^{2.8885}$
	Andaman Sea[b] (Burma)	40-60	M:52.0 F:54.0	-	-	2-9(9)	-	-	-	-	1:0.7	-	-	-	Fish, crustaceans	
Lutjanus lineolatus	Gulf of Thailand[c]	20-50	13.9	M:18.0 F:19.0	-	10-6	-	8.0	1-4	-	1:1	1-2 cm/ month	-	-	Fish, shrimps, squids	$M:W = 0.0263L^{2.754}$ $F:W = 0.0668L^{2.412}$
	Malacca Strait[d] (Indonesia)	-	-	-	-	-	-	-	-	-	1:0.72	-	-	-	-	$M:W = 0.0263L^{2.754}$ $F:W = 0.0668L^{2.412}$
	East coast of Peninsular Malaysia[e]	20-60	15.0	22.0	-	-	-	4.5	6	-	-	-	-	-	-	-
Lutjanus malabaricus	Andaman Sea[f] (Burma)	40-60	M:38.5 F:38.7	60.5	-	7-9	-	21.0	9	-	1:1.2	-	-	-	Fish, molluscs, crustaceans	
Lutjanus sanguinius	South China Sea[g] (Singapore)	-	18.0-66.0	-	-	-	374 000- 2 433 000	-	-	32.0	1:0.96	-	-	-	Fish, molluscs, crustaceans	$W = 0.066L^{2.765}$
	South China Sea[h] (Hong Kong)	40-100	-	-	-	3-4	-	-	-	-	-	-	-	-	-	-

a/ Gafa and Sadhotomo (1983)

b/ Druzhinin and Hliang (1972)

c/ Vadhanakul (1976a); Intong (1980)

d/ Wahyuono *et al.* (1983)

e/ Aglen *et al.* (1981)

f/ Druzhinin and Hliang (1972)

g/ Kangwankij (1970); Tu (1971)

h/ Lai-shing (1968)

Table 4 (continued)

(3) Goat fish. See Sections 5 and 6.2.3 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY MULLIDAE Upeneus moluccensis	Samar Sea[a]	-	-	22.5	-	-	-	-	-	-	-	k=1.1	Z=4.02 M=2.06	-	-	-
	South China Sea[b] (Hong Kong)	50-110	-	17.5	-	3-9	-	-	-	-	-	k=0.9	-	4	Crustaceans, molluscs, polychaeta	-
Upeneus sulphureus	Java Sea[c]	30-70	-	25.0	-	-	-	-	-	-	-	k=2.24	-	-	-	$W = 1.6154 \times 10^{-5} L^{2.9768}$
	Andaman Sea[d] (Burma)	31-60	M:14.6 F:13.0	18.0	-	3-9	-	10.0-11.0	2, 9	-	1:0.7	-	-	-	Crustaceans, fish	-
	Samar Sea[e]	-	-	19.5	-	-	-	-	-	-	-	k=1.2	Z=6.96 M=2.27	-	-	-
	San Miguel Bay[e]	-	-	15.3	-	-	-	-	-	-	-	k=1.05	M=2.23	-	-	-
Upeneus vitatus	Manila Bay[e]	30-60	-	24.5	-	-	-	-	-	-	-	k=0.71	Z=5.18 M=1.51	-	-	-

a/ Lai-shing (1968)

b/ Lee (1974)

c/ Badrudin (1978a)

d/ Druzhinin and Hliang (1972)

e/ Ingles and Pauly (1984)

Table 4 (continued)

(4) Threadfin bream. See Sections 5 and 6.2.4 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month		Size (cm)	Season (month)							
FAMILY NEMIPTERIDAE *Nemipterus hexodon*	Gulf of Thailand[a]	10-40	M:16.46 F:15.12	M:27.3 F:24.4	-	All around 1-4, 6-8	-	11.0, 12.0	5, 9, 11	-	1:0.97	(1-2)	-	-	Fish, crustaceans	M:$W=0.1161L^{3.04}$ F:$W=0.0176L^{2.924}$
	Java Sea[b]	-	-	24.5	-	-	-	10.4	-	-	-	k=0.6	Z=2.54	-	-	-
Nemipterus japonicus	Gulf of Thailand[c]	20-50	-	M:25.6 F:23.3	-	-	-	10.0	-	-	-	M:k=0.1599 F:k=0.1207	M:Z=5.482 F:Z=4.814	-	-	-
	South China Sea[d] (Hong Kong)	27-46	-	-	-	3-5	-	-	-	-	-	-	-	-	-	-
	Andaman Sea[e] (Burma)	31-40	M:20.3 F:17.9	27.0	-	-	-	14.0	1	-	1:0.37	-	-	-	-	-
	Java Sea[b]	-	-	23.5	-	-	-	10.5	-	-	-	k=0.7	Z=2.24	-	-	-
	Manila Bay[f]	-	-	30.0	-	-	-	-	-	-	-	k=0.73	Z=3.31 M=1.41	-	-	-
Nemipterus nematophorus	Gulf of Thailand[g]	15-50 (>40)	M:13.34 F:11.67	M:25.84 F:17.8	-	1-4, 8, 11	-	-	-	11.7	1:0.85	M:k=0.1436 F:k=0.2275	-	-	-	-
	Lingayen Gulf[f]	-	-	22.0	-	-	-	-	-	-	-	k=0.43	Z=1.48 M=1.12	-	-	-
	Visayan Sea[f]	-	-	27.0	-	-	-	-	-	-	-	k=0.65	Z=3.38 M=1.39	-	-	-

a/ Rugvichai (1977)

b/ Dwiponggo and Pauly (in press)

c/ Amornchairojkul and Boonwanich (1982)

d/ Lai-shing (1968)

e/ Druzhinin and Hliang (1972)

f/ Ingles and Pauly (1984)

g/ Vadhanakul (1980); Boonwanich (1981)

Table 4 (4) (continued)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY NEMIPTERIDAE *Nemipterus virgatus*	South China Sea[a]	69-128	-	-	-	3-5	-	-	-	-	-	-	-	-	-	-
Nemipterus mesoprion	Gulf of Thailand[b]	30-60	M:13.0 F:11.1	M:19.51 F:15.52	-	2-4	-	6.5-7.0	3, 5, 6	-	1:1.1	M:k=0.179 (1.08) F:k=0.224 (0.85)	-	-	Fish, molluscs, crustaceans	M:W = $0.18\times10^{-5}L^{2.93}$ F:W = $7.8\times10^{-5}L^{3.10}$
	Java Sea[c]	-	-	21.5	-	-	-	10.8	-	-	-	k=0.8	Z=3.25	-	-	-
Nemipterus peronii	Gulf of Thailand[d]	30-60	M:22.9 F:21.6	M:27.5 F:27.0	-	2-4	-	15.2, 15.5, 15.7	3, 7, 9, 12	-	1:0.84	-	-	-	Worms, fish, squids, crustaceans	M:W = $0.0122L^{2.988}$ F:W = $0.0199L^{3.004}$
Nemipterus ovenii	Visayan Sea[e]	20-140	14.0	25.0	-	-	-	5.5-8.0	2, 10, 12	-	1:1.4	k=0.42	Z=1.52 M=1.06	-	-	$W=0.00895L^{3.26}$
Nemipterus delagoae	Malacca Strait[f] (Indonesia)	-	-	-	-	-	-	-	-	-	1:1.24	-	-	-	-	$W=0.0201L^{2.7735}$
Scolopsis taeniopterus	Gulf of Thailand[g]	10-40	M:21.7 F:14.6	M:27.0 F:25.0	-	All around 12-1, 4-8	-	-	6-7, 11-12	-	1:0.8	-	-	-	Crustaceans, fish	M:W = $1.08\times10^{-4}L^{2.6201}$ F:W = $6.17\times10^{-5}L^{2.718}$

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a/ Lai-shing (1968)

b/ Boonwanich (1980); Vadhanakul (1981)

c/ Dwiponggo and Pauly (in press)

d/ Isarankura (1968); Isarankura and Pariyanond (1963)

e/ Ingles and Pauly (1984); Arce (1981)

f/ Wahyuono *et al.* (1983)

g/ Thumniyom and Charnprasertporn (1977)

Table 4 (continued)

(5) Bigeye snappers. See Sections 5 and 6.2.5 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY PRIACANTHIDAE Priacanthus macracanthus	North of Java[a]	-	7.5-22.7	26.0	-	2-4, 9-11	-	12.7	-	-	-	k=1.36	Z=5.42 M=3.45	4-5	-	$W=8.7x10^{-5}L^{2.667}$
Priacanthus tayenus	Gulf of Thailand[b]	40-50	M:27.0 F:25.0	-	-	All around 1-3	56 000-152 000	11.0, 12.0, 10.5	3, 5, 10, 12	14.0	1:1	2.0 cm/month	-	-	Crustaceans, fish, squid	$M{:}W=3.16x10^{-6}L^{2.919}$ $F{:}W=2.606x10^{-6}L^{2.891}$
	Andaman Sea[c] (Thailand)	-	-	11.9	-	10-4	-	-	-	15.0	1:0.72	-	-	-	-	$\text{Log } W = -3.3815 + 2.4607 \text{ Log} L$
	Samar Sea[d]	-	-	29.0	-	-	-	-	-	-	-	k=1.25	Z=8.95 M=8.09	-	-	-

[a] Nugroho et al. (1983)

[b] Chomjurai (1970); Wetchagarun (1971)

[c] Chantawong et al. (1984)

[d] Ingles and Pauly (1984)

Table 4 (continued)

(6) Groupers. See Sections 5 and 6.2.6 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month		Size (cm)	Season (month)							
FAMILY SERRANIDAE *Epinephelus sexfasciatus*	South China Sea[a] (Singapore)	30-60	–	86.5	–	1-4, 8-9	2.0-2.7 million	–	–	45-50	–	k=0.14	–	–	–	–
	Gulf of Thailand[b]	20-70	–	–	–	–	–	–	–	–	–	–	–	–	Fish, crustaceans, molluscs, polychaetae	–

a/ Tan (1974)

b/ Intong (1980a)

Table 4 (continued)

(7) Croakers. See Sections 5 and 6.2.7 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at forst maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY SCIAENIDAE *Dendrophysa russelli*	San Miguel Bay[a]	-	-	17.5	-	-	-	-	-	-	-	k=0.95	Z=5.32 M=2.01	-	-	-
	Gulf of Thailand[b]	-	M:11.97 F:11.52	M:16.0 F:15.5	-	All around 12-2	-	-	3, 6, 9, 11, 1	-	1:1	1 cm	-	-	-	$W = 1.259x10^{-7} L^{2.9927}$
Johnius dussumieri	Andaman Sea[c] (Burma)	20-60	M:21.8 F:21.2	25.0	-	3-9	-	-	-	-	-	-	-	-	-	-
Otolithes lateoides	Andaman Sea[c] (Burma)	20-60	M:20.3 F:19.7	25.5	-	1-9	-	-	-	-	1:0.6	-	-	-	Fish, crustaceans	-
Otolithes ruber	San Miguel Bay[a]	-	-	29.5	-	-	-	-	-	-	-	k=0.44	Z=1.71 M=1.025	-	-	-
Pennahia macrophthalmus	Manila Bay[a]	-	-	26.5	-	-	-	-	-	-	-	k=1.4	Z=5.55 M=2.30	-	-	-
	San Miguel Bay[a]	-	-	20.0	-	-	-	-	-	-	-	k=0.6	Z=2.28 M=1.43	-	-	-

a/ Ingles and Pauly (1984)

b/ Phettongkam and Thasananukulkij (1972)

c/ Druzhinin and Hliang (1972)

Table 4 (continued)

(8) Lizardfish. See Sections 5 and 6.2.8 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY SYNODONTIDAE Saurida elongata	Gulf of Thailand[a]	10-20	M:26.3 F:30.6	M:37.7 F:41.6	< 30 mi	1-3, 8-9	-	-	5-7, 11	-	-	M:K=0.103 1.4 cm/month F:K=0.099 1.5 cm/month	M:Z=5.622 F:Z=5.278	-	-	M:W = $5.644 \times 10^{-6} L^{3.054}$ F:W = $6.565 \times 10^{-6} L^{3.024}$
Saurida tumbil	Gulf of Thailand[b]	-	M:26.31 F:30.56	M:34.0 F:40.0	-	1-3	-	-	5-7, 12	-	1:1	-	-	-	-	-
	Andaman Sea[c] (Burma)	21-60	29.5	38.0	-	2.8	-	-	-	-	1:1.7	-	-	-	-	-
	Manila Bay[d]	-	37.0	All year round	-	-	28 000	7.0-8.0	11-2	M:17.0-19.0 F:19.0-21.0	1:0.8	K=1.03 0.66 cm/month	Z=4.83 M=1.71	-	Fish	-
	Visayan Sea[d]	-	41.0	2-5, 7-9	-	-	-	-	-	-	-	k=0.70	Z=2.22 M=1.30	-	-	-
Saurida undosquamis	Gulf of Thailand[e]	41-50	M:17.8 F:18.31	M:36.5 F:26.5	-	12-1, 5-9	-	12.0-14.0	6, 12, 2	-	1:0.57	2.0 cm/month	-	-		W = $0.000002929 L^{3.163}$
	Java Sea and Malacca Strait[f] (Indonesia)	-	-	33.5	-	-	-	15.15	-	-	1:31	k=0.95	Z=2.9	-	-	M:W = $0.0002 L^{4.0843}$ F:W = $0.0002 L^{4.0759}$
	Visayan Sea[g]	-	-	30.5	-	-	-	-	-	-	-	k=0.80	Z=4.07	-	-	-

a/ Charnprasertport (1979)

b/ Chomdej (1966)

c/ Druzhinin and Hliang (1972)

d/ Tiews, Mines and Ronquillo (1972); Ingles and Pauly (1984)

e/ Intong (1971, 1976); Shinoda and Intong (1977)

f/ Wahyuono *et al.* (1983); Dwiponggo and Pauly (in press)

g/ Ingles and Pauly (1984)

Table 4 (8) (continued)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY SYNODONTIDAE *Saurida longimanus*	Java Sea[a/]	-	-	20.5	-	-	-	11.28	-	-	-	k=1.0	Z=2.19	-	-	-
Saurida micropectolaris	Java Sea and Malacca Strait[b/] (Indonesia)	-	-	42.0	-	-	-	13.84	-	-	1:0.56	k=0.875	Z=3.73 M=1.5	-	-	M:W = $0.0028L^{3.2812}$ F:W = $0.0189L^{2.7424}$

a/ Dwiponggo and Pauly (in press)

b/ Dwiponggo and Pauly (in press); Wahyuono *et al.* (1983)

Table 5

Important biological features and parameters; shrimps in the region
(1) Penaeus spp. See Sections 5 and 6.3 for annotations and broader references

(Body size refers to total length unless specified as CL: carapace length or g: body weight in grammes; sexes are combined unless specified as M: male or F: female)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY PENAEIDAE Penaeus indicus	Malacca Strait[a]	-	-	-	-	All around 1-4, 7-10	124 000 1 500 000	-	-	-	-	-	-	-	Phyto-planktons, polychaeta, feraminifera	-
	South China Sea[b] (Brunei)	-	-	20.0 CL (60 g)	-	4, 9-11	-	-	11, 4	3.0 CL	-	3.2 cm CL/ 6 months	-	-	-	Log W = 2.922 Log C-0.16
Penaeus merguiensis	Gulf of Thailand[c]	15-30	-	-	-	1-3, 9-12	129 650-960 950	-	-	13.0-14.2	-	-	-	-	Polycheata, fish, copepods, euphausia	M:W = $0.0000100L^{2.963}$ F:W = $0.00000497L^{3.113}$
	Andaman Sea[d] (Thailand)	-	-	-	-	7-8	-	-	-	13.0	-	-	-	-	-	-
	South China Sea[b] (Brunei)	-	4.85 CL	-	Inshore	All around 6, 9	-	2.2 CL	10, 2	-	1:1	2-3 g/ month, 1.7 cm/ 97 days	-	-	-	M:Log W = 3.04 Log C-0.033 F:Log W = 3.06 Log C-0.04
	Manila Bay[e]	-	-	-	-	-	-	-	-	-	-	-	-	-	Zoo/phyto-planktons, bentic feraminifera, ostracods, copepods	-
	San Miguel Bay[e]	-	-	-	-	-	-	-	-	-	-	-	-	-	Same as above	-

a/ Pathansali et al. (1974)

b/ Currie (1982)

c/ Hutasing (1974); Vibhasiri and Kongmuag (1976, 1976a); Thubtimsang (1977); Thubtimsang and Meechukhan (1976); Thubtimsaeng (1978, 1978a)

d/ Kungvankij et al. (1973, 1973a)

e/ Tiews, Bravo and Ronquillo (1972)

Table 5 (1) (continued)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY PENAEIDAE Penaeus merguiensis (continued)	Java Sea[a/]	-	6-12	24.6	-	3, 4, 8, 11, 12	-	-	-	2.6 CL 12.5	1:1.18	k=1.2	Z=5.98 M=3.16	-	-	-
	South China Sea[b/] (Sabah, Malaysia)	-	-	-	-	-	-	-	-	3.38 CL	1:1.18	-	-	-	-	-
Penaeus canaliculatus	Malacca Strait[b/] (Malaysia)	-	-	-	-	-	200 000	-	-	-	-	-	-	-	-	-
	Manila Bay[c/]	> 40	-	-	-	-	-	-	-	-	-	-	-	-	Zoo/phytoplanktons, benthic foraminifera, ostracods, copepods, fish eggs	-
	San Miguel Bay[c/]	-	-	-	-	-	-	-	-	-	-	-	-	-	Same as above	-
Penaeus japonicus	Gulf of Thailand[d/]	30-39	17.7	25.0	-	1-3, 10-12	730 000	11.0	-	15.0-15.6	0.74:1	-	-	-	Phyto/zooplanktons, molluscs, cephalopods	M:W = $0.000007L^{3.0087}$ F:W = $0.000004L^{3.1213}$
Penaeus latisulcatus	Gulf of Thailand[e/]	10-19	12.9	20.9	-	All around 1-3, 7-8	257 889-1 009 459	7.0	-	14.0	1:1	-	-	-	Shrimps, crabs, cephalopods, molluscs	M:W = $0.0000712L^{2.5703}$ F:W = $0.0000149L^{2.9018}$
Penaeus longistylus	Gulf of Thailand[f/]	10-19	13.9	22.4	-	-	-	-	-	-	-	-	-	-	-	-
Penaeus monodon	Gulf of Thailand[g/]	30-39	24.5	31.9	-	All around 1-3, 6-7	100 000-300 000	-	-	20.0	1:1	-	-	-	Polychaeta, decapeda, euphausiacea	

a/ Martosubroto (1977); Sumiono (1983); Adisusilo (1983)

b/ Pathansali et al. (1974)

c/ Tiews, Bravo and Ronquillo (1972)

e/ Thubtimsang and Meechukhan (1976); Chaitiamvong (1980); Chaitiamvong and Thaiprayoon (1979)

f/ Vibhasiri (1984)

Table 5 (1) (continued)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY PENAEIDAE *Penaeus monodon* (continued)	Andaman Sea[a] (Thailand)	-	-	-	-	2, 8	-	-	-	20.0	-	-	-	-	-	-
	Malacca Strait[b] (Malaysia)	-	-	-	-	-	300 000	-	-	-	-	-	-	-	-	-
	Arafura Sea[c] (Indonesia)	-	-	43.0	-	-	-	-	-	21.0	-	k=1.63	Z=5.05	-	-	-
	South China Sea[d] (Brunei)	16	M:8–64 g F:11–175 g	-	-	-	-	-	-	-	-	-	-	-	-	-
Penaeus semisulcatus	Gulf of Thailand[e]	35–40	147	-	-	5–6	178 438–855 579	-	-	15.1	0.94:1	-	-	-	Crustaceans, molluscs, squids	$M:W = 0.00000945L^{2.9947}$ $F:W = 0.00000216L^{3.2931}$
	Andaman Sea[a] (Thailand)	-	-	-	-	2, 8	-	-	-	16	-	-	-	-	-	-
	Malacca Strait[b] (Malaysia)	-	-	-	-	-	-	-	-	-	-	-	-	-	Zoo-phyto-planktons, benthos, feraminifera	
	Manila Bay[f]	-	-	-	-	-	-	-	-	-	1:0.5	-	-	-	Zoo/phyto-planktons, benthos, feraminifera, molluscs, echinodermata, fish eggs	-

a/ Kungvankij *et al.* (1973a)

b/ Pathansali *et al.* (1974)

c/ Dwiponggo and Pauly (in press); Naamin (1984)

d/ Currie (1982)

e/ Thubtimsang and Meechukhan (1976); Thubtimsang (1977); Thubtimsaeng (1978, 1978a)

f/ Tiews, Bravo and Ronquillo (1972)

Table 5 (continued)

(2) Metapenaeus spp. See Sections 5 and 6.3 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY PENAEIDAE *Metapenaeus affinis*	Gulf of Thailand[a/]	10–19	-	-	-	2, 7	13 502–87 630	-	-	9.3–11.5	1:1	-	-	-	Molluscs, fish, crustaceans	M:W = $0.0000529L^{2.6182}$ F:W = $0.00000724L^{3.05}$
	South China Sea[b/] (Brunei)	10–45	3–4 g	19 g	Off shore to 45 m	2–4, 9–12	-	-	6–7	-	-	-	-	-	-	M:Log W = 2.939 Log C–0.036 F:Log W = 3.067 Log C–0.092
Metapenaeus brevicornis	Gulf of Thailand[c/]	-	5.0–9.5	-	-	All around	258 000–1 000 000	-	-	-	-	-	-	-	Phyto/zooplanktons, feraminifera	
	South China Sea[b/] (Brunei)	-	-	-	2–4, 9–10	All around	-	1.7–5.2	All around	-	-	1 g/month	-	-	-	M:Log W = 3.124 Log C–0.091 F:Log W = 2.673 Log C–0.028
Metapenaeus ensis	Gulf of Thailand[d/]	10–19	-	-	-	1–4, 9–10	56 107–146 091	-	-	9.8	-	-	-	-	Cephalopods, fish, molluscs	M:W = $0.0002295L^{2.31}$ F:W = $0.00001737L^{2.858}$
	Java Sea[e/]	-	-	-	-	3.12	-	-	-	9.5 2.0 CL	-	-	-	-	-	-
Metapenaeus intermedius	Gulf of Thailand[f/]	20–39	13.4	19.4	-	3, 6, 9–12	45 200–604 359	-	-	9.0	1:1	-	-	-	Crustaceans, fish, cephalopods, molluscs, copepods, polychaeta	M:W = $0.000017L^{2.8534}$ F:W = $0.000023L^{2.858}$

a/ Thubtimsang and Meechukhan (1976); Thubtimsang (1977); Thubtimsaeng (1978, 1978a); Chaitiamvong and Thaiprayoon (1977, 1978a)

b/ Currie (1982)

c/ Chaitiamvong and Thaiprayoon (1979)

d/ Thubtimsang and Meechukhan (1976); Thubtimsang (1977); Chaitiamvong and Thaiprayoon (1979)

e/ Martosubroto (1977)

f/ Thubtimsang and Meechukhan (1976); Chaitiamvong and Phunwichian (1980)

Table 5 (2) (continued)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY PENAEIDAE *Metapenaeus monoceros*	Manila Bay[a]	-	12.5	-	-	-	-	-	-	-	-	-	-	-	Zoo/phyto-planktons, benthic organisms, shrimps, annelida	-
	San Miguel Bay[a]	-	-	-	-	-	-	-	-	-	-	-	-	-	Same as above	-

[a] Tiews, Bravo and Ronquillo (1972)

Table 5 (continued)

(3) *Acetes* spp. See Sections 5 and 6.3 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY SERGESTIDAE *Acetes erythraeus*	Gulf of Thailand[a]	-	0.8-3.3	3.3	-	-	-	-	-	-	0.78.1	-	-	-	-	-
Acetes indicus	Gulf of Thailand[a]	-	1.4-2.6	3.3	-	-	-	-	-	-	0.6:1	-	-	-	-	-
Acetes japonicus	Gulf of Thailand[a]	-	0.7-2.1	2.2	-	-	-	-	-	-	0.51:1	-	-	-	-	-
Acetes vulgaris	Gulf of Thailand[a]	-	1.0-2.7	3.3	-	-	-	-	-	-	1.13:1	-	-	-	-	-

[a] Chaitianuong (1980a)

Table 6

Important biological features and parameters; cephalopods in the region
(1) Squids. See Sections 5 and 6.4 for annotations and broader references

(Body size refers to mantle length; sexes are combined unless specified as M: male or F: female)

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY LOLIGINIDAE *Loligo edulis*	Lombok[a/] Strait	10-20	-	-	-	-	-	-	-	-	-	-	-	-	-	$W=0.0066L^{1.74}$
Loligo duvaucellii	Gulf of Thailand[b/]	30-40	3.0-22.5	-	-	All around 2-5	1 000 000 4 000 000	-	-	5.6	1:1.3	-	-	-	-	$M{:}W = 0.0081L^{1.189}$ $F{:}W$ $0.0014L^{1.975}$
Loligo chinensis	Gulf of Thailand[c/]	40-50	4.5-40.9	40.9	-	All around 5, 11	800-7 000	-	-	-	-	-	-	-	Fish, molluscs, crustaceans	$M{:}W = 0.0014L^{1.975}$ $F{:}W = 0.000165L^{2.184}$
Loligo uyii	Gulf of Thailand[d/]	10-20	3.0-8.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Sepietheutis lessoniana	Gulf of Thailand[e/]	20-30	3.0-26.1	26.1	-	All around	480-1 020	-	-	13.7	1:1.6	1.8-2.0 cm/month	-	-	Crustaceans, fish, cephalopods	$M{:}W = 0.007657L^{1.846}$ $F{:}W = 0.002437L^{2.10}$

a/ Marzuki (1983); Marzuki *et al.* (1983)

b/ Rattanaanun (1977, 1980)

c/ Rattanaanun (1977)

d/ Cholatarn (1978)

e/ Rattanaanun (1980)

Table 6 (continued)

(2) Cuttlefishes. See Sections 5 and 6.4 for annotations and broader references

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
			Mean (cm)	Maximum (cm)	Area	Season (month)		Size (cm)	Season (month)							
FAMILY SEPIIDAE *Sepia pharaonis*	Gulf of Thailand[a]	20-30	3.8-26.0	26.0	-	All around 1, 7	780-2 500	-	-	14.3	1:1.8	1.5-2.0 cm/month	-	-	Crustaceans, fish	M:W = $0.000604L^{2.629}$ F:W = $0.000706L^{2.609}$
Sepia aculeata	Gulf of Thailand[b]	10-30	2.0-18.9	-	-	All around 3-4, 7-9	650-3 900	-	-	8.1	1:1.4	-	-	-	Fish, crustaceans	M:W = $6.23x10^{-4}L^{2.607}$ F:W = $4.88x10^{-4}L^{2.677}$
Sepia recurvirostra	Gulf of Thailand[c]	20-30	3.2-12.3	-	-	All around 2-3, 6-10	310-1 370	.	-	6.7	1:1.3	-	-	-	Crustaceans, fish, cephalopods	M:W = $0.001863L^{2.369}$ F:W = $0.00123L^{2.468}$
Sepia inermis	Gulf of Thailand[d]	10-20	2.0-10.5	-	-	-	-	-	-	-	1:2.6	-	-	-	-	-
Sepia brevimana	Gulf of Thailand[a]	30-40	2.4-8.2	9.0	-	-	3 312-6 565	-	-	-	1:2.2	-	-	-	Crustaceans, fish	M:F = $0.000607L^{2.599}$ W:F = $0.000764L^{2.549}$
Sepia lycidas	Gulf of Thailand[d]	10-20	5.8-21.7	-	-	-	-	--	-	-	1:2	-	-	-	-	-

a/ Chotiyaputta (1982)

b/ Supongpan and Kongmuag (1976, 1976a)

c/ Supongpan and Kongmuag (1976, 1976a); Chotiyaputta (1982)

d/ Cholatarn (1978)

Table 6 (continued)

(3) Octopuses. See Sections 5 and 6.4 for annotations and broader references[a]

Species	Area (country) surveyed	Vertical distribution range (m)	Body size captured		Spawning		Fecundity	Recruitment		Size at first maturity (cm)	Sex ratio (M:F)	Growth (rate or coefficient)	Mortality (coefficient)	Life span (year)	Food organisms	Length-weight relationship
FAMILY OCTOPODIDAE *Octopus membranaceous*	Gulf of Thailand[b]	10-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octopus dollfusi	Gulf of Thailand[b]	10-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] Although three other species are believed to be widely distributed in the region (Chikuni, 1983; Roper, Sweeney and Nauen, 1984), much attention has not been paid by fishermen

[b] Cholatarn (1978)

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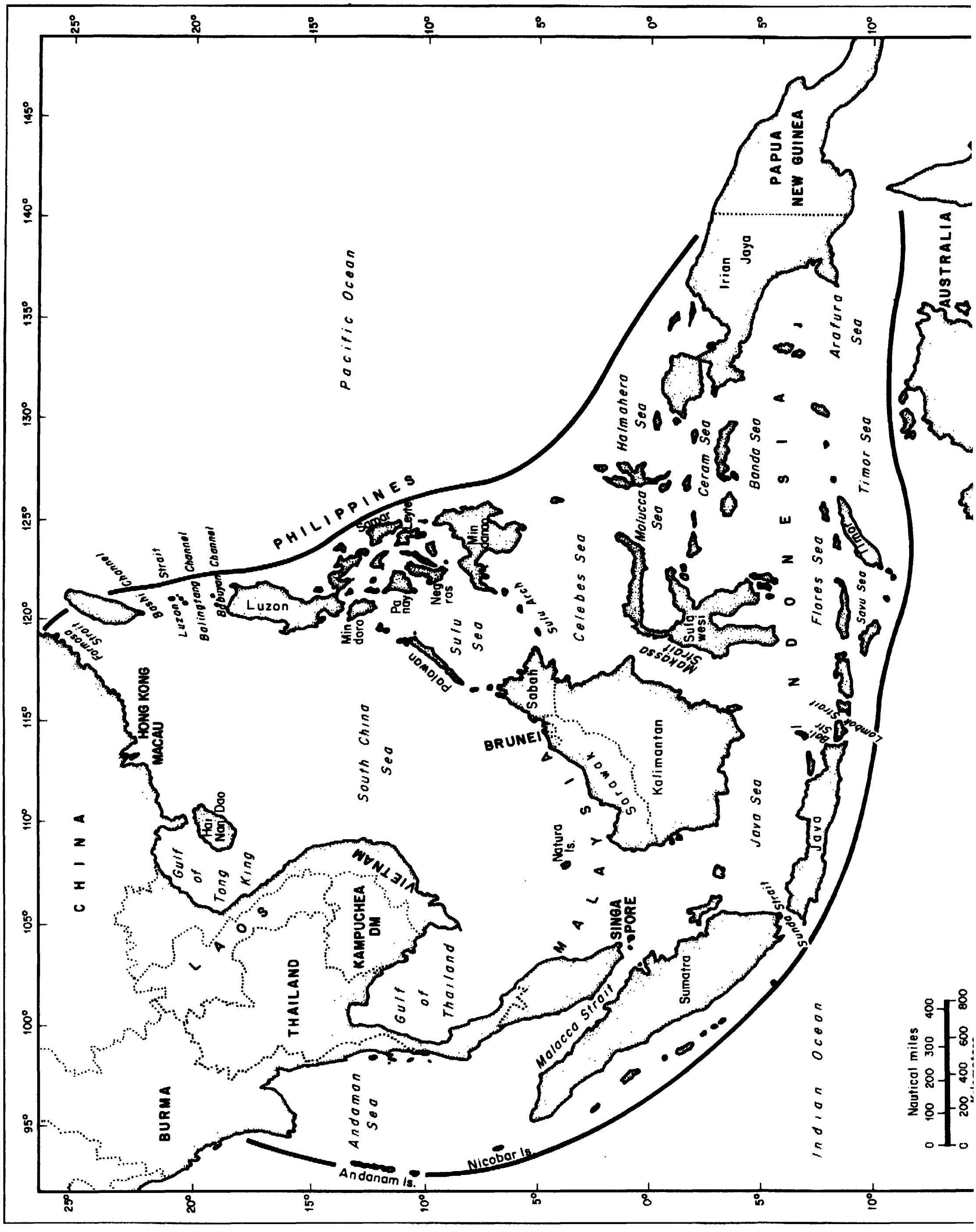
21. Estimated seasonal pattern of migration and displacement of major species groups in the region 84


CHINA
BURMA
THAILAND
LAOS
KAMPUCHEA DM
VIETNAM
HONG KONG
MACAU
Hai Nan Dao
Gulf of Tong King
Gulf of Thailand
Andaman Sea
Andanam Is.
Nicobar Is.
Indian Ocean
South China Sea
Pacific Ocean
Formosa Strait
Bashi Channel
Bashi Strait
Luzon Strait
Balingtang Channel
Babuyan Channel
PHILIPPINES
Luzon
Samar
Leyte
Min doro
Pa nay
Neg ros
Min danao
Palawan
Sulu Sea
Sulu Arch.
Celebes Sea
Sabah
BRUNEI
Sarawak
Kalimantan
MALAYSIA
SINGAPORE
Natura Is.
Malacca Strait
Sumatra
Sunda Strait
Java
Java Sea
Bali Strait
Lombok Strait
Makassar Strait
Sulawesi
INDONESIA
Molucca Sea
Halmahera Sea
Ceram Sea
Banda Sea
Flores Sea
Savu Sea
Timor
Timor Sea
Arafura Sea
Irian Jaya
PAPUA NEW GUINEA
AUSTRALIA
Nautical miles
0 100 200 300 400
0 200 400 600 800
25° 20° 15° 10° 5° 0° 5° 10°
95° 100° 105° 110° 115° 120° 125° 130° 135° 140° 145°

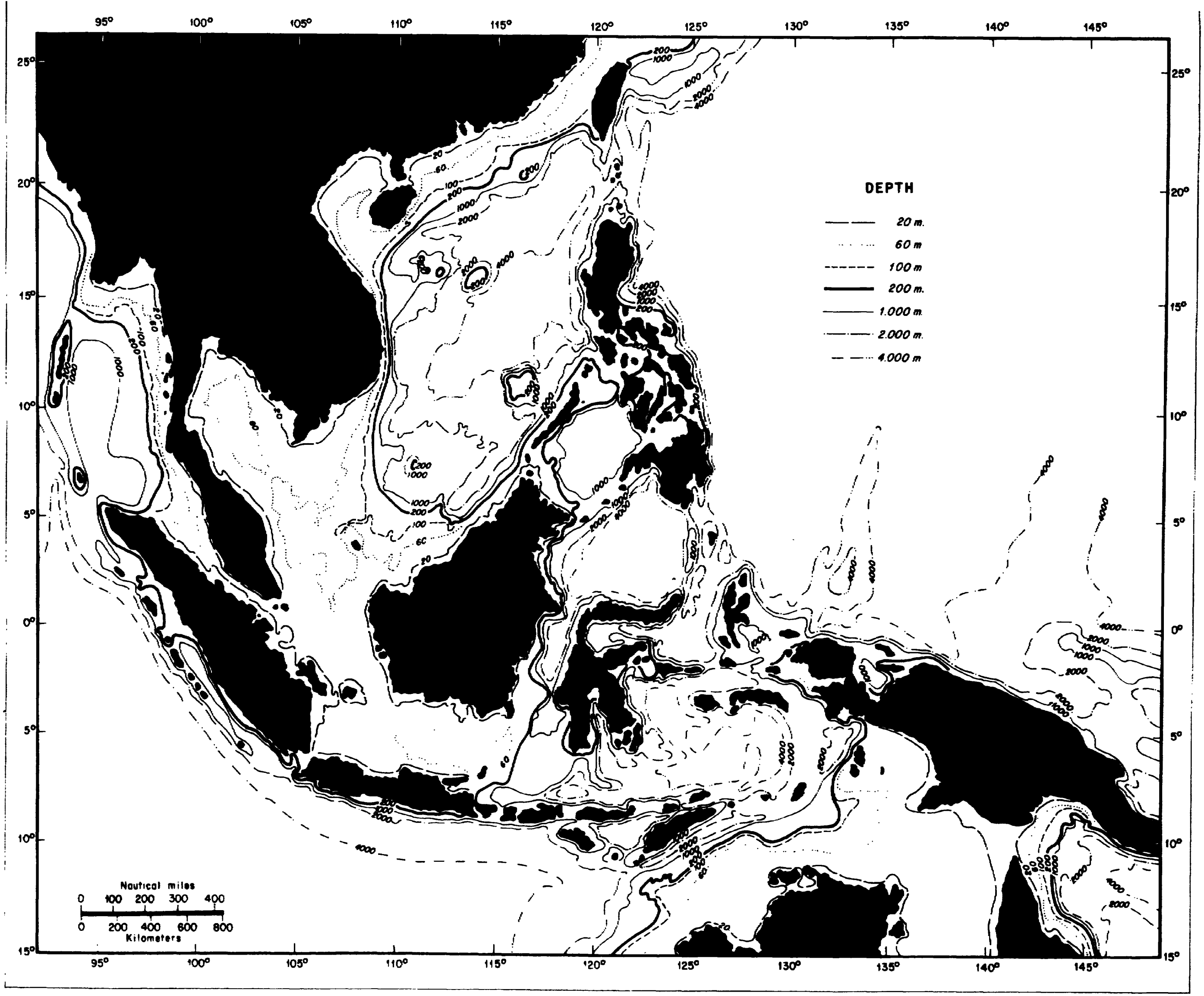
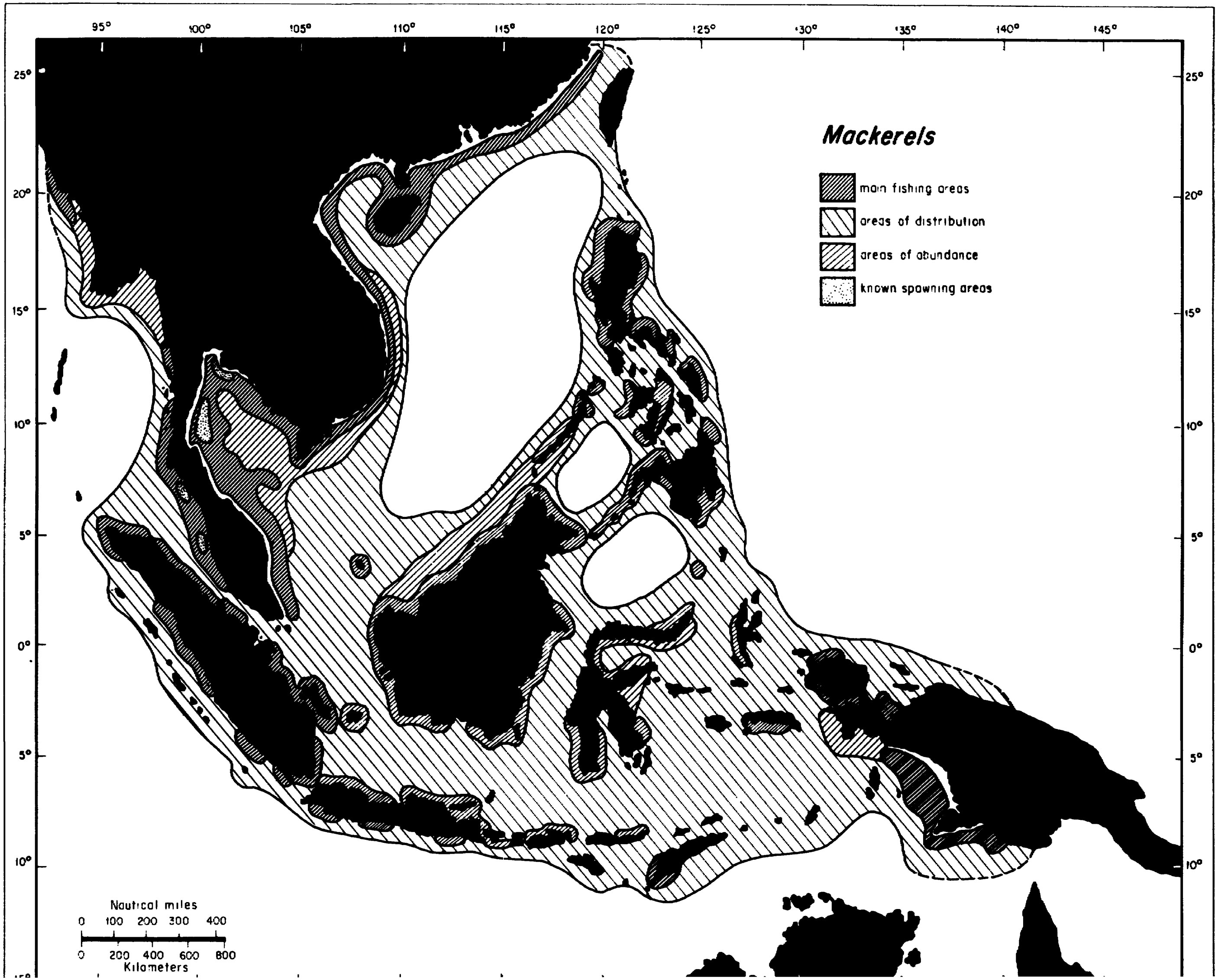


Figure 2 Bathymetric condition of the region. See Section 3 of the text for annotations



Mackerels
▨ main fishing areas
▧ areas of distribution
▨ areas of abundance
░ known spawning areas
95°
100°
105°
110°
115°
120°
125°
130°
135°
140°
145°
25°
20°
15°
10°
5°
0°
5°
10°
Nautical miles
0 100 200 300 400
0 200 400 600 800
Kilometers

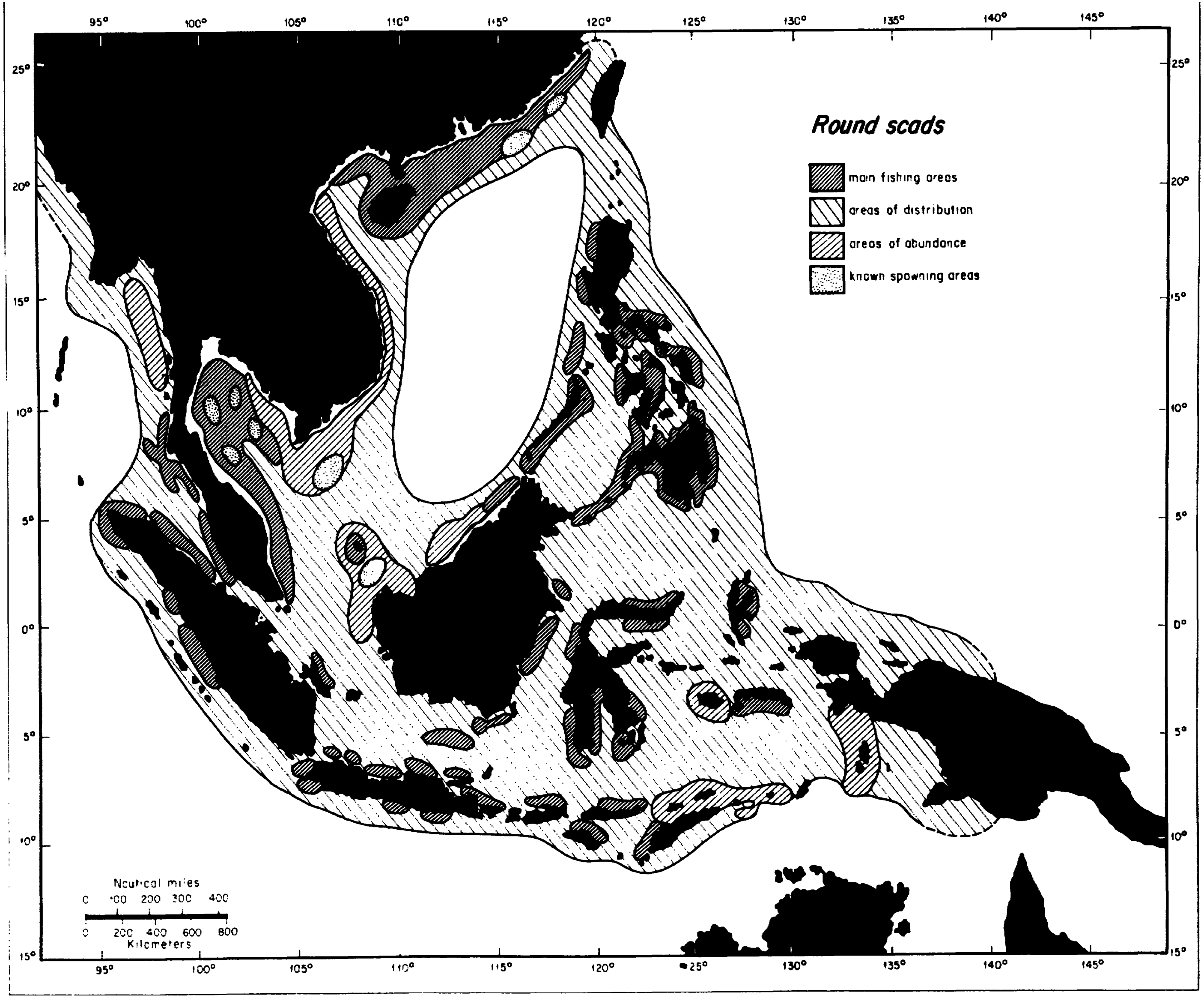
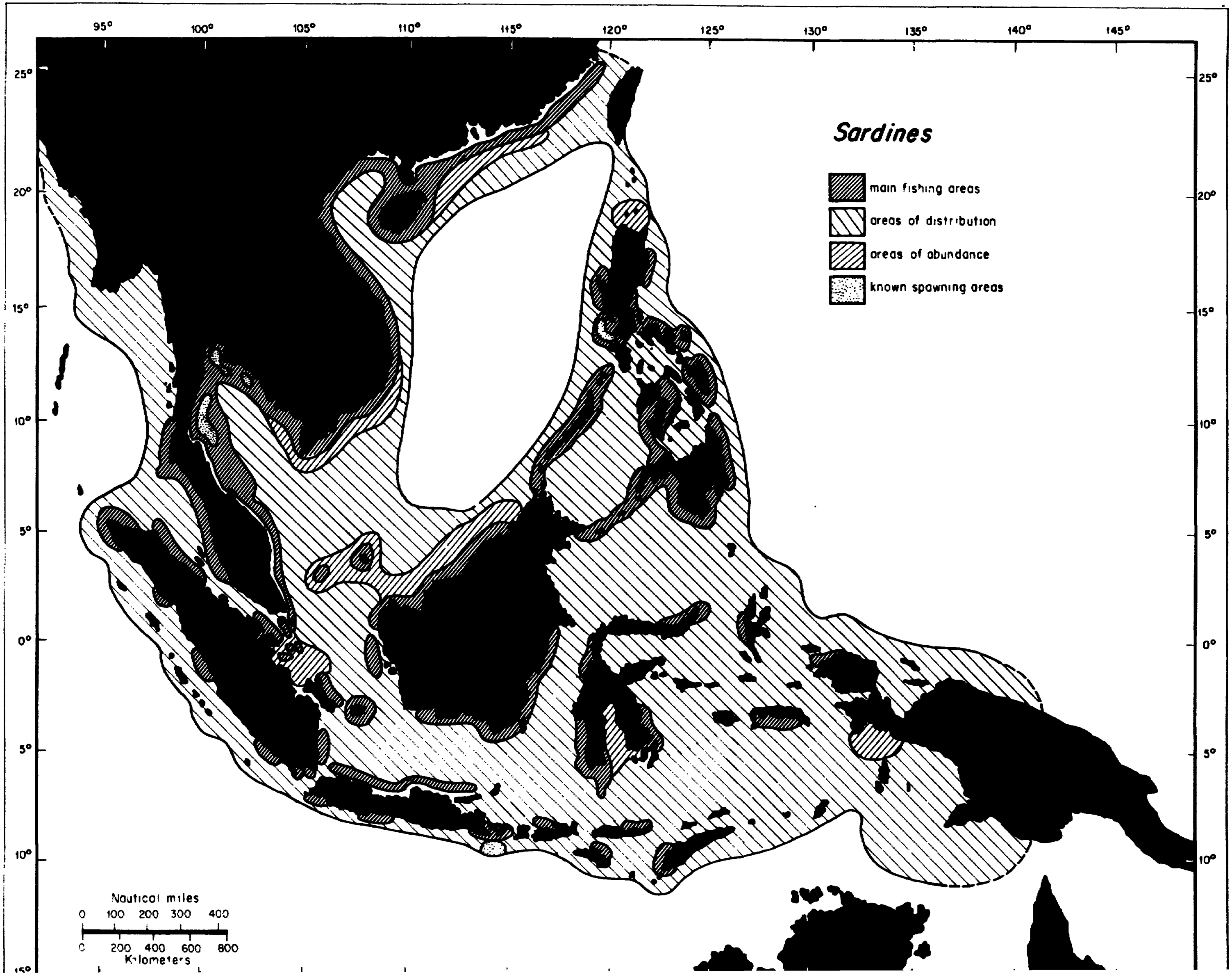


Figure 4 Geographic distribution; round scads. See Section 6.1.2 of the text for annotations and references


Sardines
main fishing areas
areas of distribution
areas of abundance
known spawning areas
Nautical miles
0 100 200 300 400
0 200 400 600 800
Kilometers
95°
100°
105°
110°
115°
120°
125°
130°
135°
140°
145°
25°
20°
15°
10°
5°
0°
5°
10°

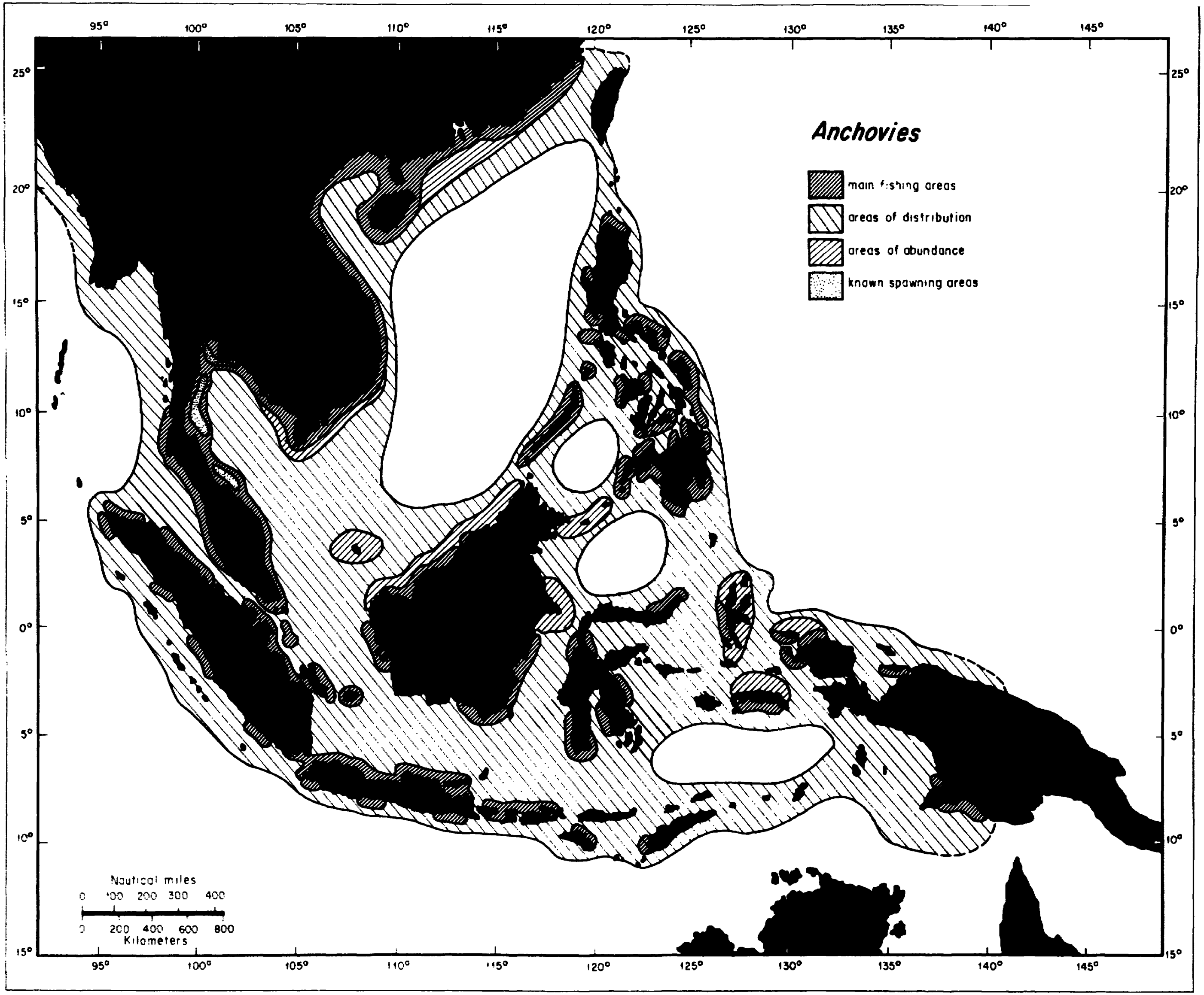
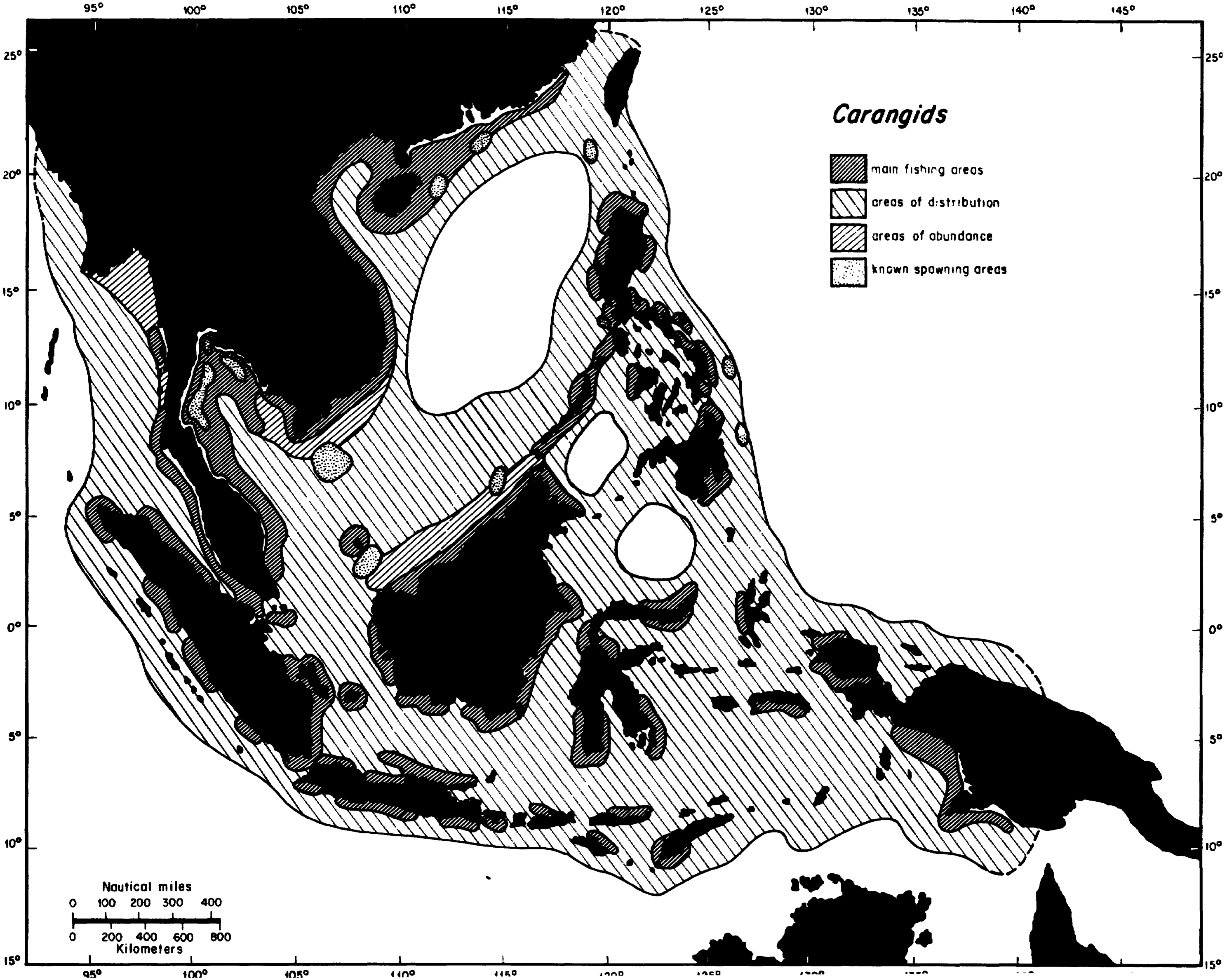


Figure 6 Geographic distribution: anchovies. See Section 6.1.4 of the text for annotations and references


Carangids
main fishing areas
areas of distribution
areas of abundance
known spawning areas
Nautical miles
0 100 200 300 400
0 200 400 600 800
Kilometers
95° 100° 105° 110° 115° 120° 125° 130° 135° 140° 145°
25° 20° 15° 10° 5° 0° 5° 10° 15°

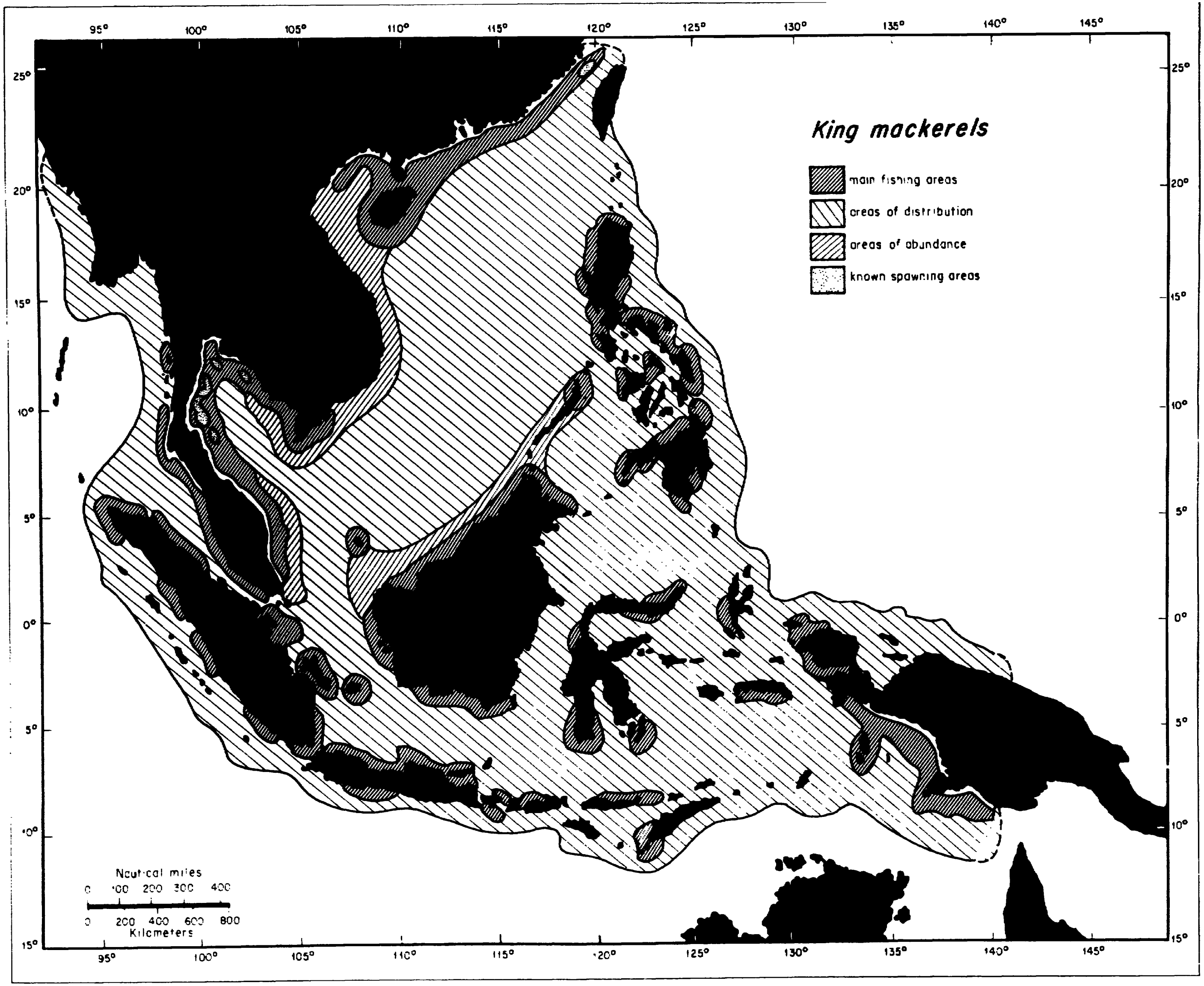


Figure 8 Geographic distribution; king mackerels. See Section 6.1.6 of the text for annotations and references

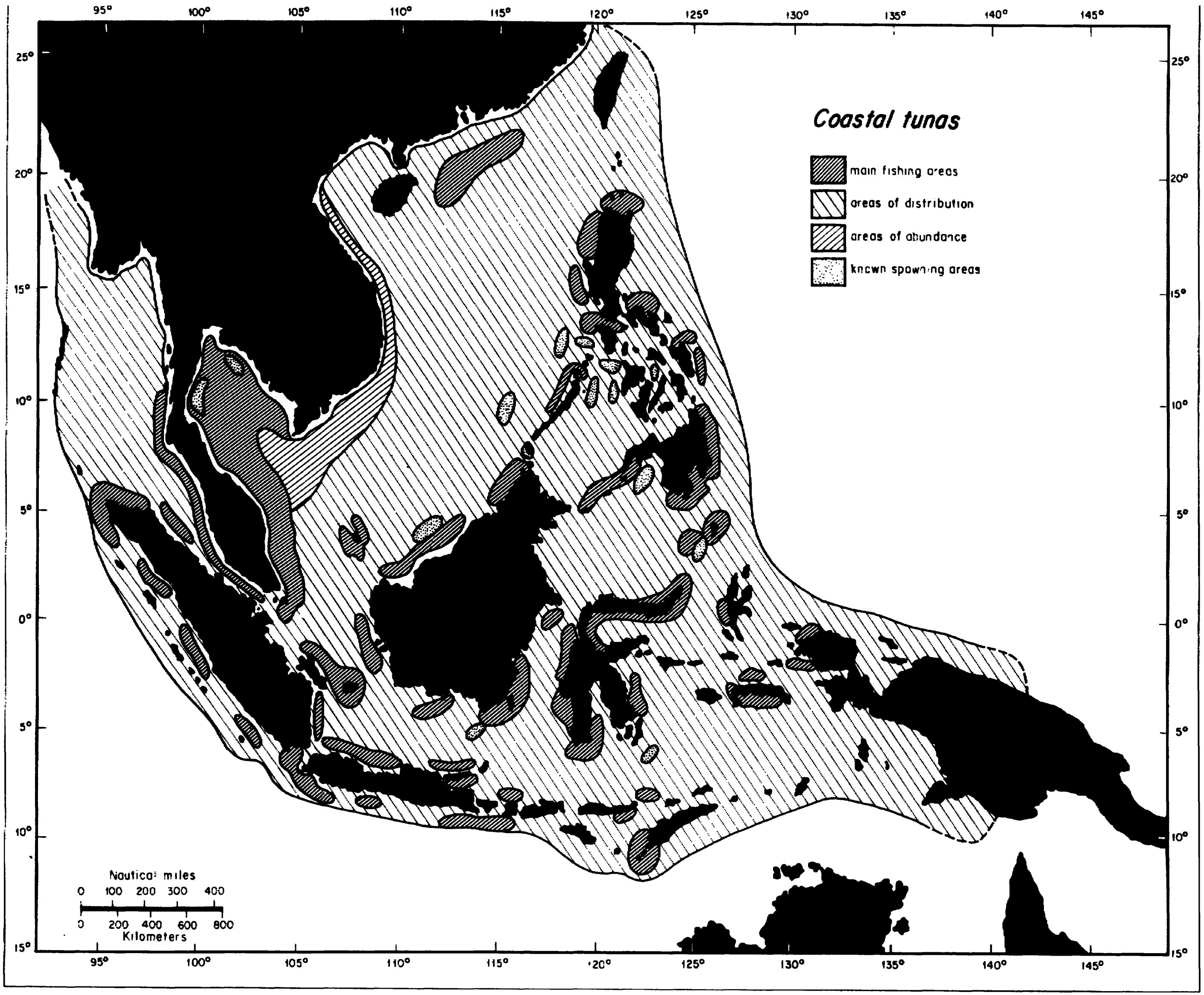


Figure 9 Geographic distribution; coastal tunas. See Section 6.1.7 of the text for annotations and references

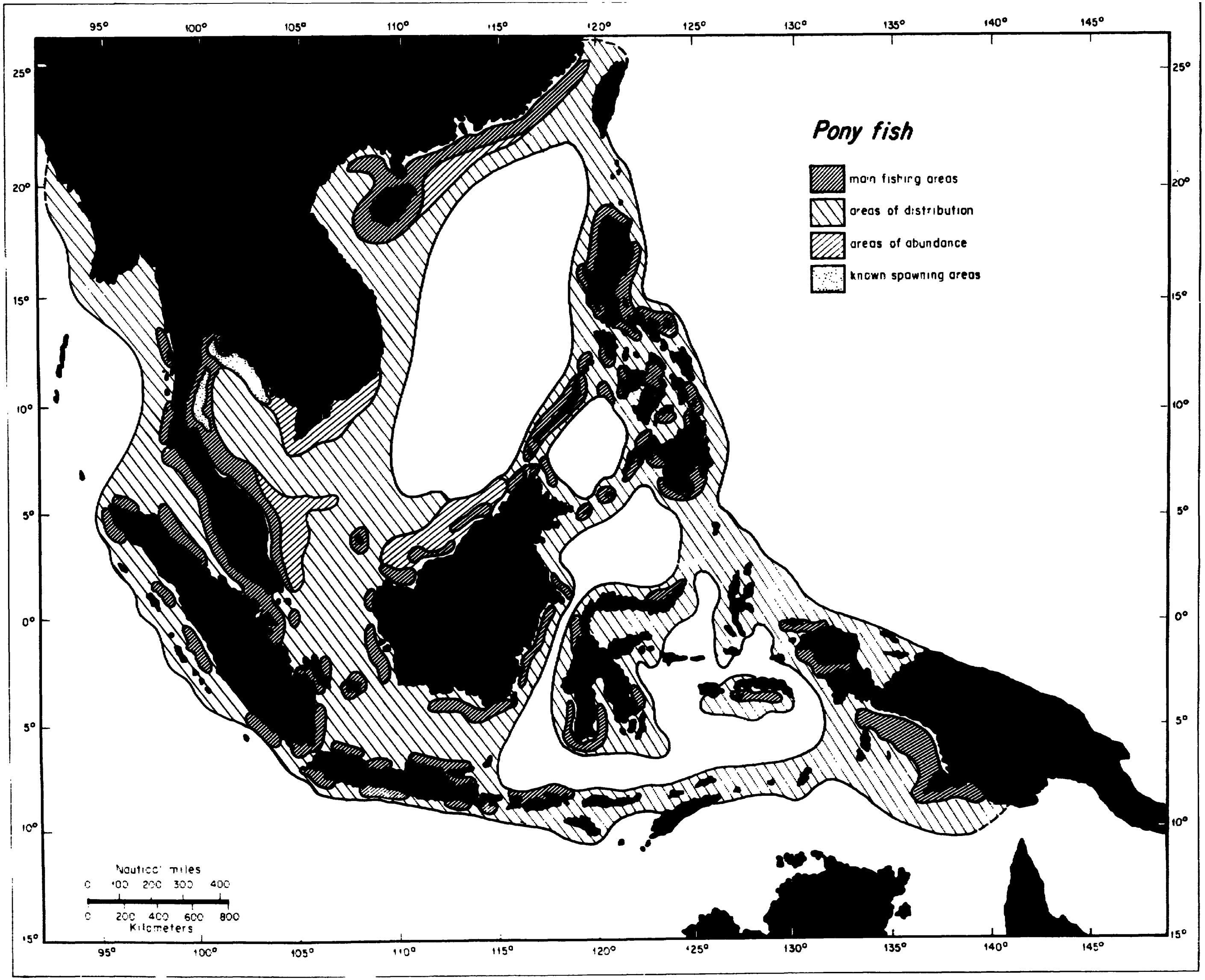


Figure 10 Geographic distribution; pony fish. See Section 6.2.1 of the text for annotations and references

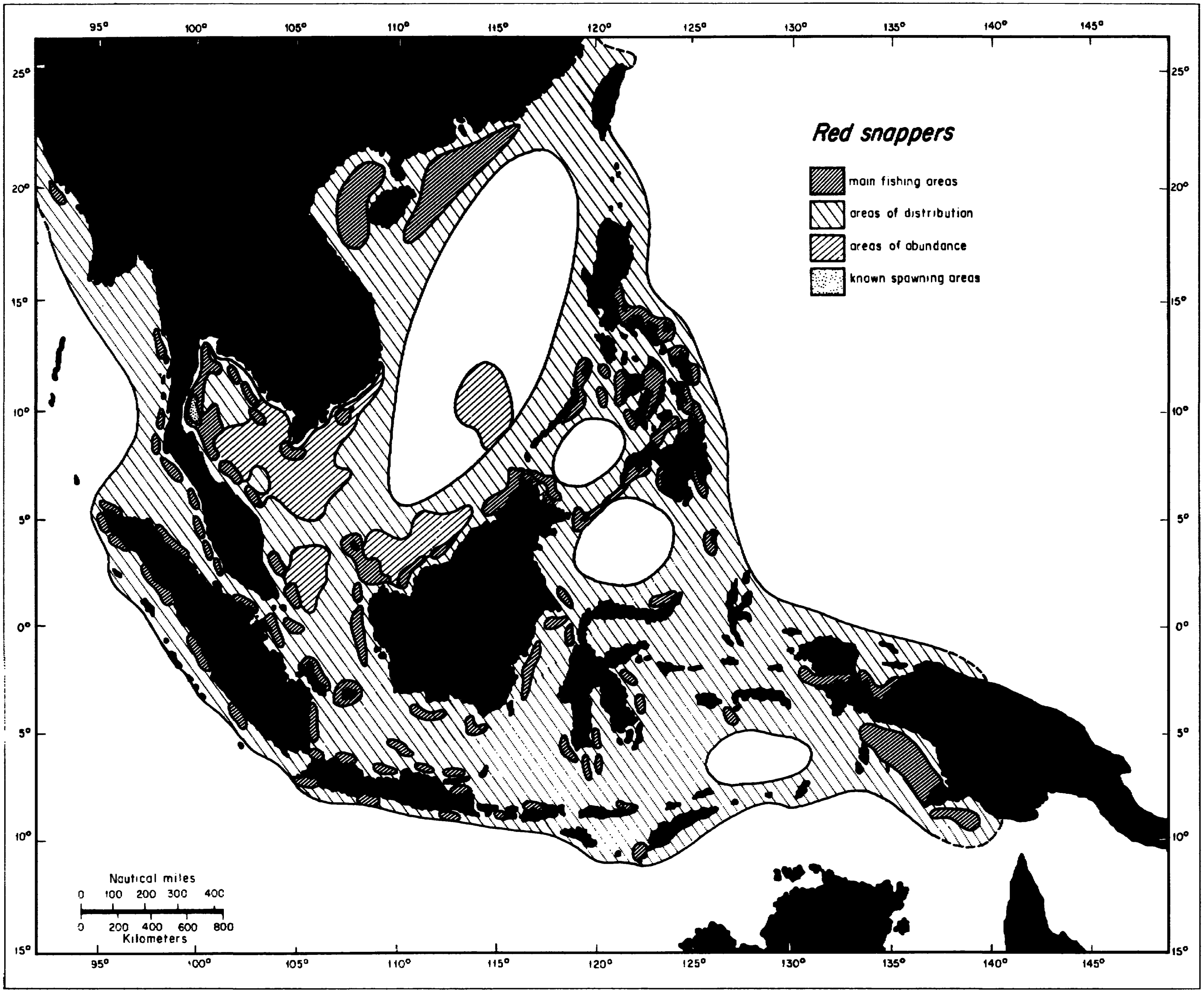


Figure 11 Geographic distribution; red snappers. See Section 6.2.2 of the text for annotations and references

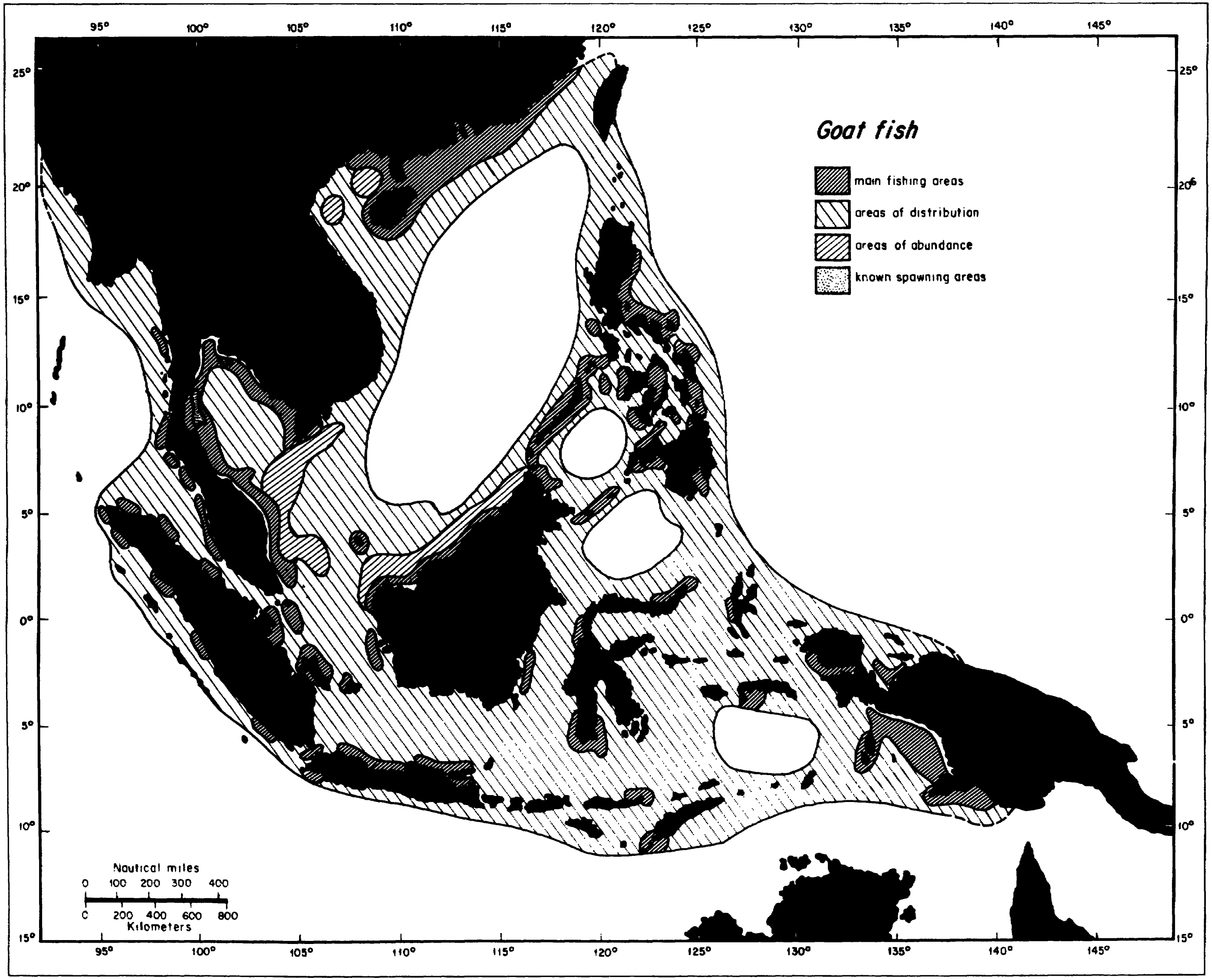


Figure 12 Geographic distribution; goat fish. See Section 6.2.3 of the text for annotations and references

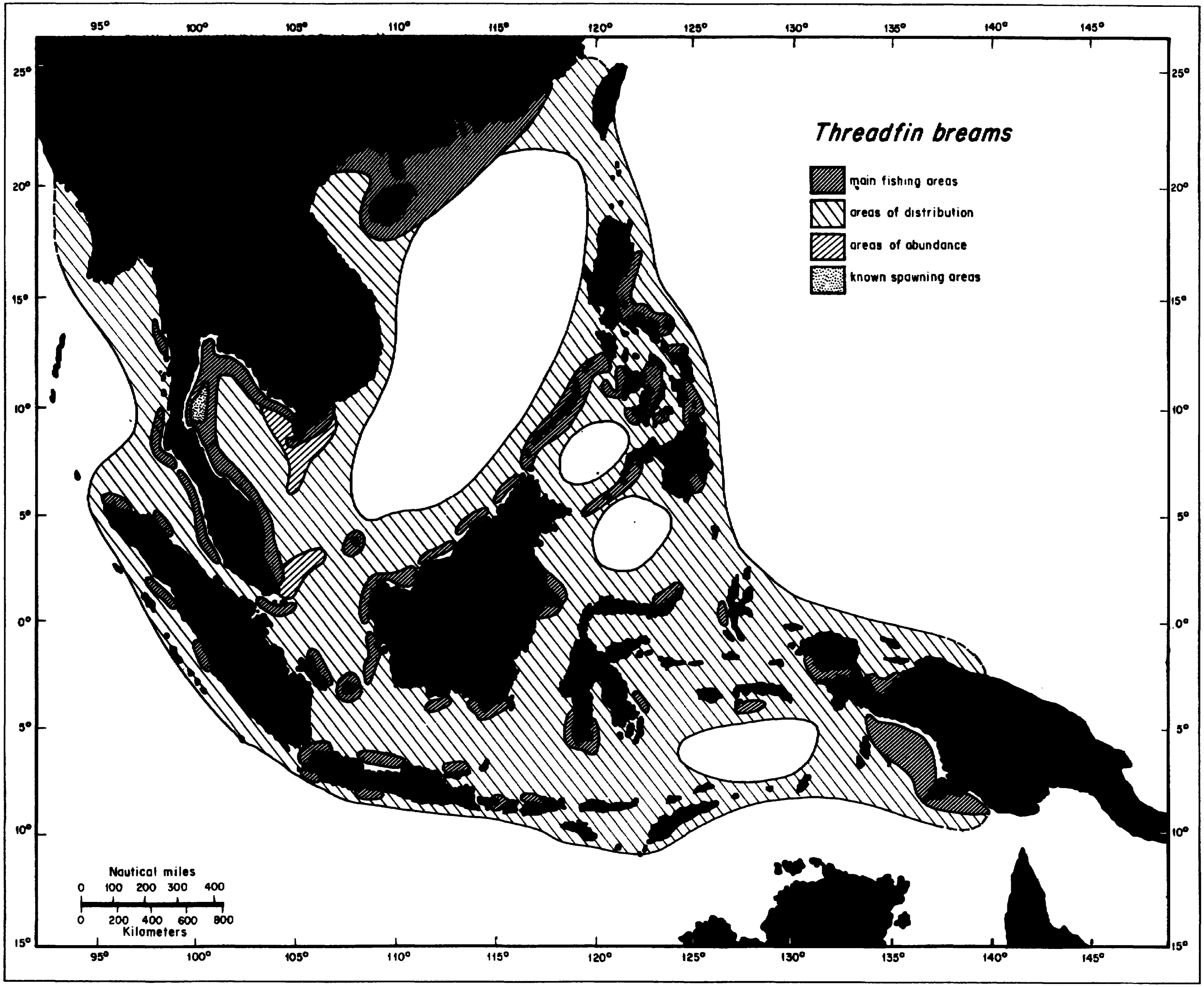


Figure 13 Geographic distribution; threadfin breams. See Section 6.2.4 of the text for annotations and references

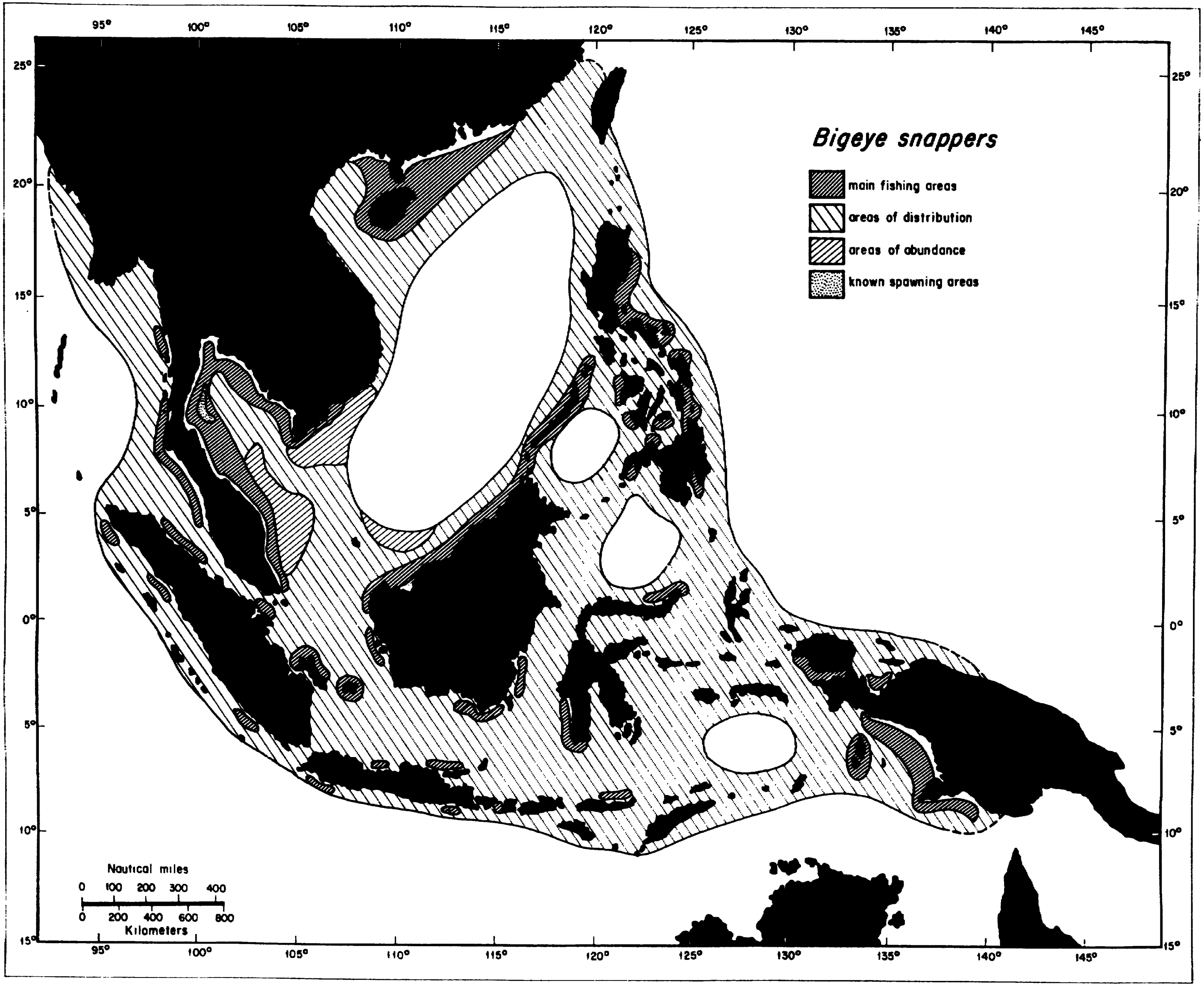


Figure 14 Geographic distribution; bigeye snappers. See Section 6.2.5 of the text for annotations and references

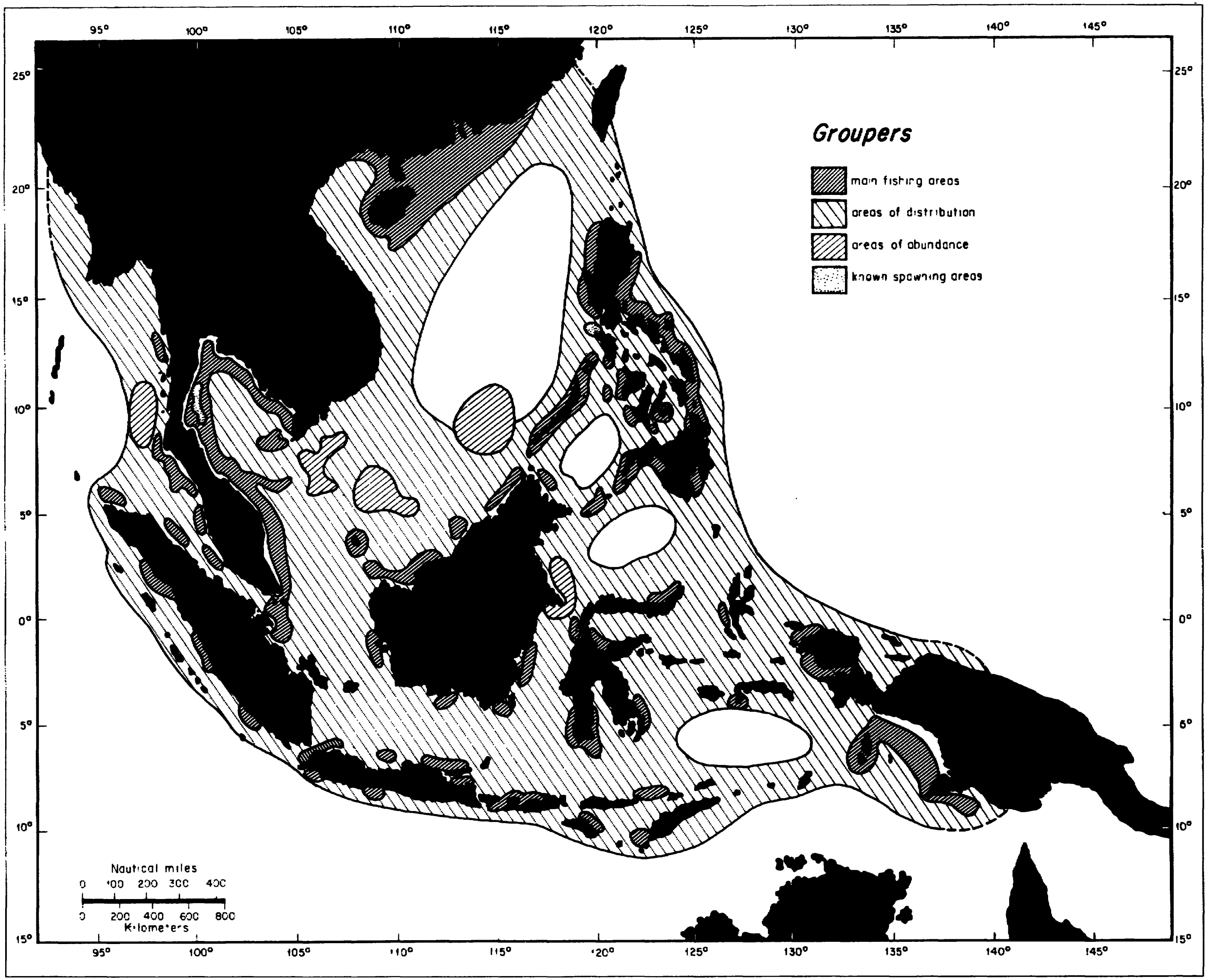


Figure 15 Geographic distribution; groupers. See Section 6.2.6 of the text for annotations and references

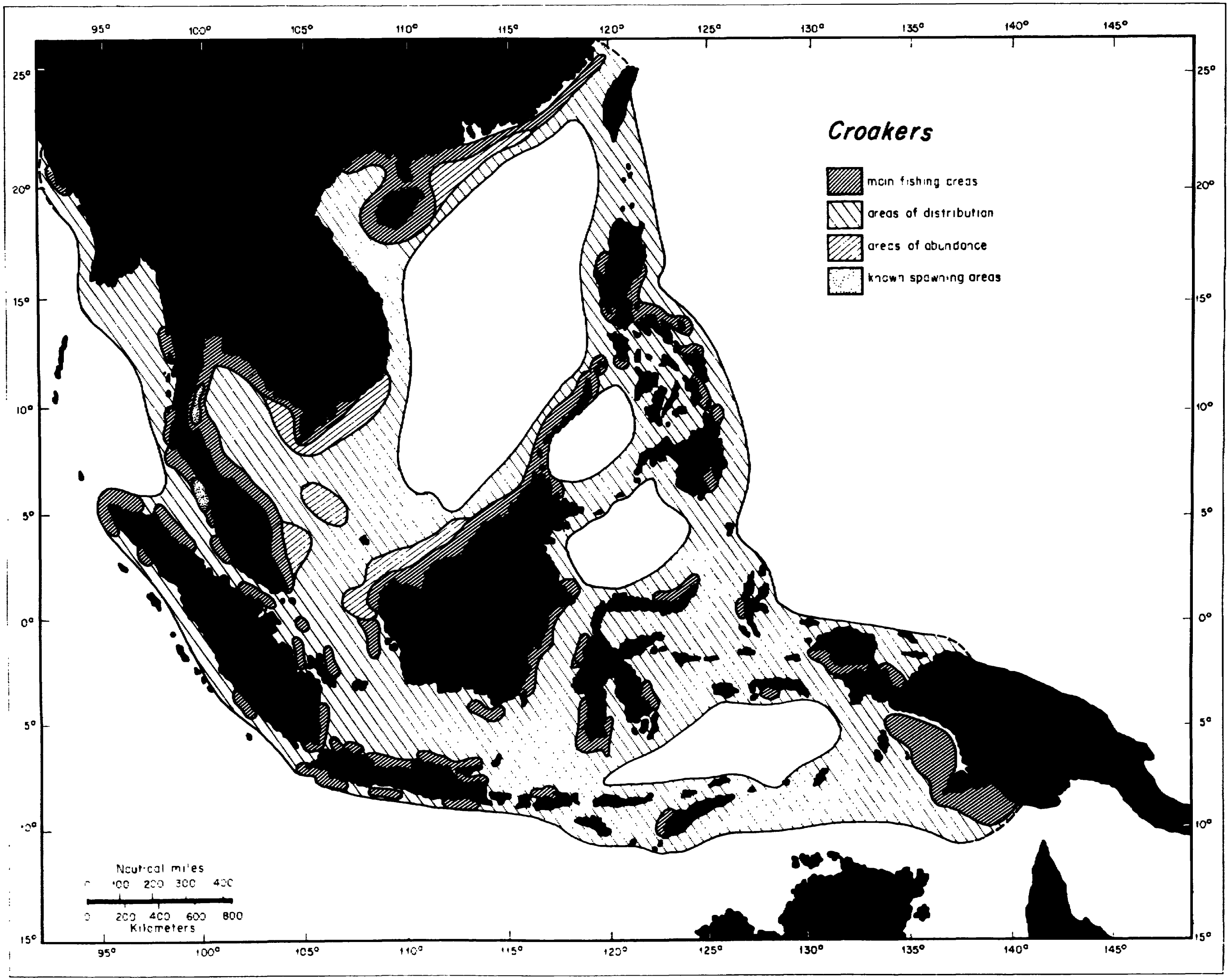


Figure 16 Geographic distribution; croakers. See Section 6.2.7 of the text for annotations and references

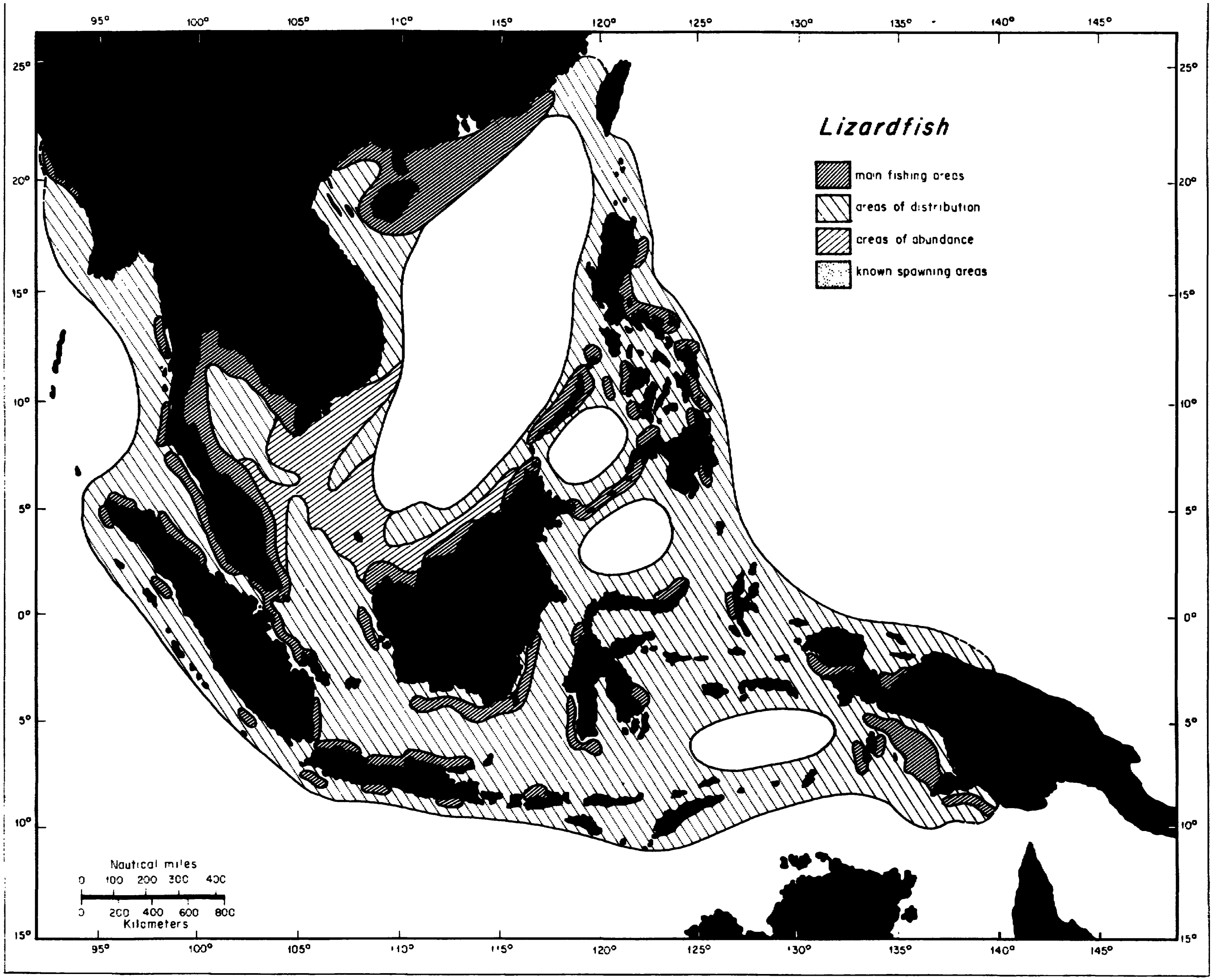


Figure 17 Geographic distribution; lizardfish. See Section 6.2.8 of the text for annotations and references

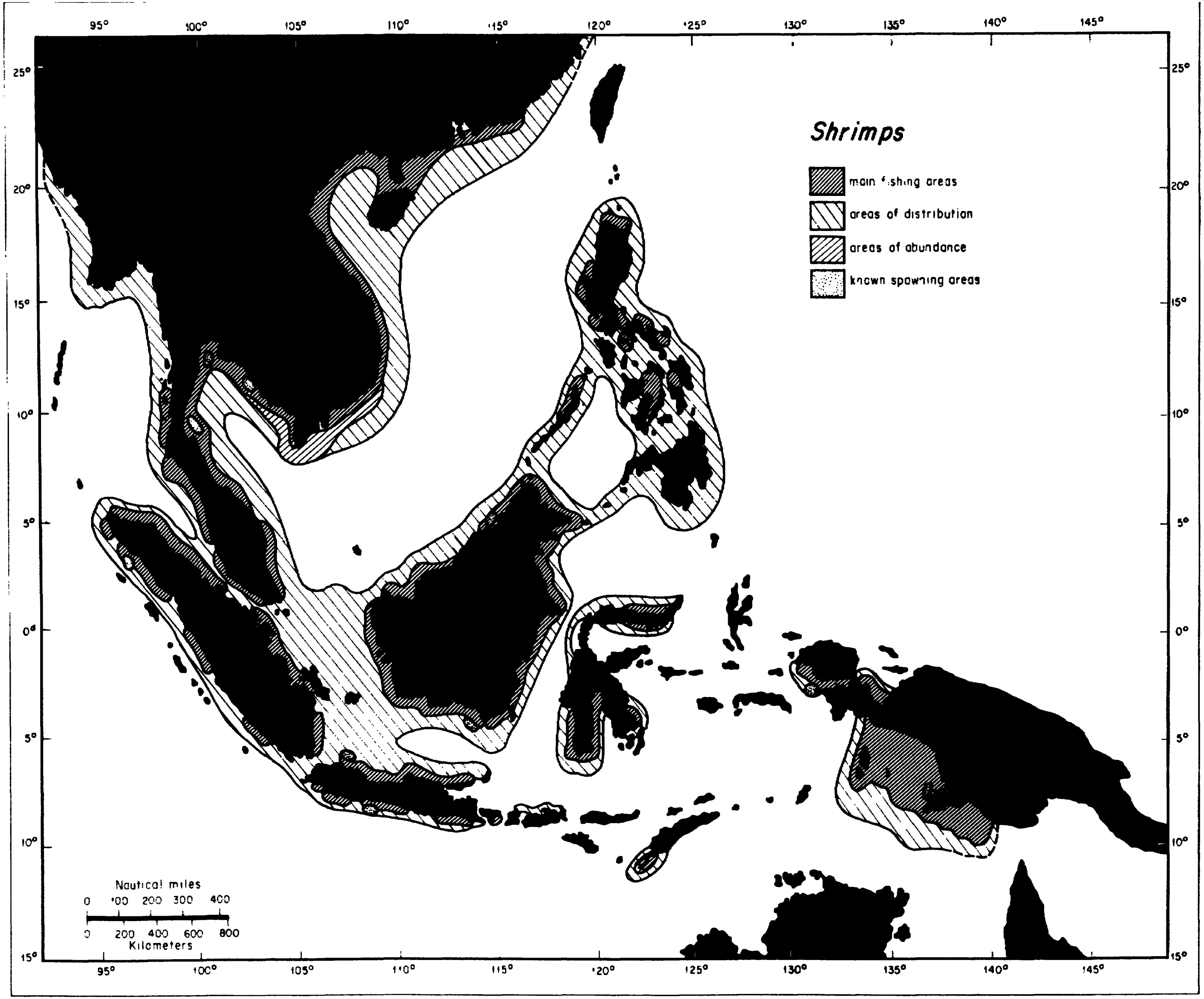


Figure 18 Geographic distribution; shrimps. See Section 6.3 of the text for annotations and references

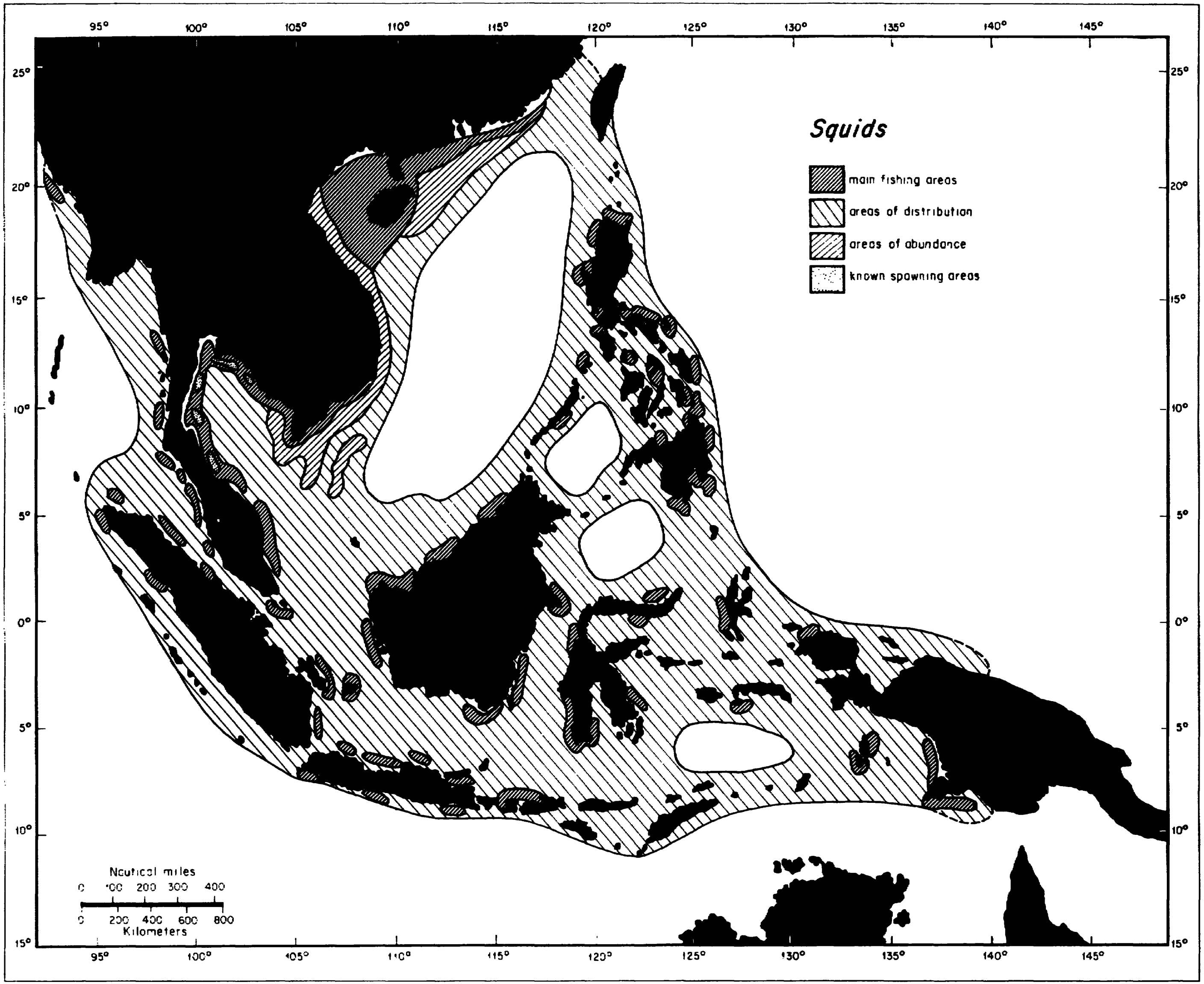


Figure 19 Geographic distribution; squids. See Section 6.4 of the text for annotations and references

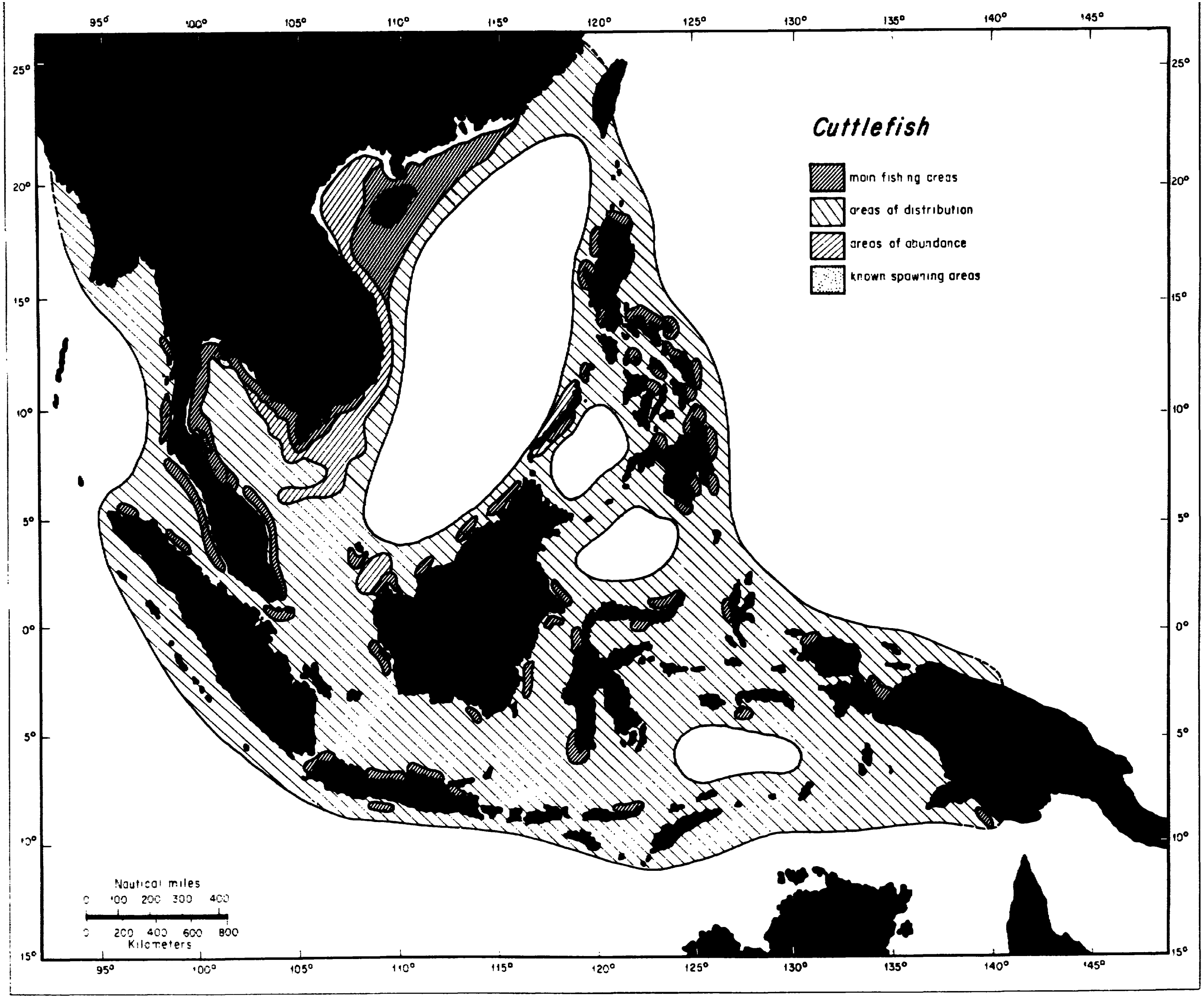


Figure 20 Geographic distribution; cuttlefish. See Section 6.4 of the text for annotations and references